United States Department of Agriculture

Soil Conservation Service

In cooperation with United States Department of the Interior, Bureau of Land Management; United States Department of Agriculture, Forest Service; and Oregon Agricultural Experiment Station

Soil Survey of Jackson County Area, Oregon

How To Use This Soil Survey

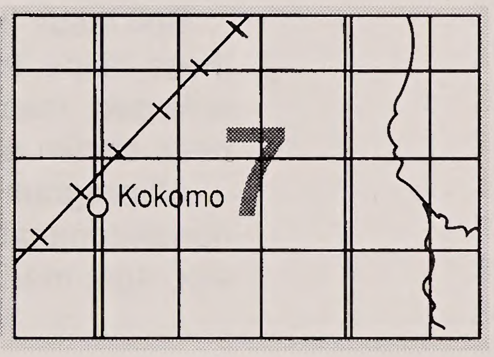
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

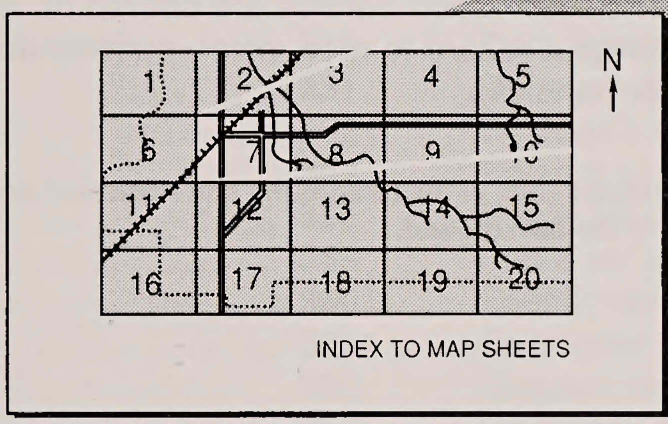
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



MAP SHEET

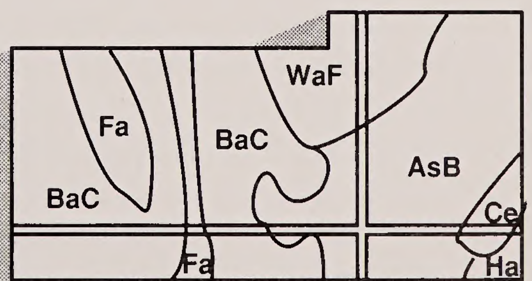
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.

MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1987. Soil names and descriptions were approved in 1989. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This survey was made cooperatively by the Soil Conservation Service and Forest Service, the Bureau of Land Management, and the Oregon Agricultural Experiment Station. It is part of the technical assistance furnished to the Jackson County Soil and Water Conservation District and the Klamath County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Typical area of Terrabella soils in the foreground and Freezener and Geppert soils in the center. Mt. McLoughlin is in the background.

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Issued August 1993

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Foreword

This soil survey contains information that can be used in land-planning programs in the Jackson County Area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for the maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Jack P. Kanalz
State Conservationist
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Soil Survey of Jackson County Area, Oregon

By David R. Johnson, Soil Conservation Service

Fieldwork by David R. Johnson, Duane Setness, Russell A. Almaraz, Roger Borine, Laurel Fischer Mueller, and Roger Pfenninger, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with United States Department of the Interior, Bureau of Land Management; United States Department of Agriculture, Forest Service; and Oregon Agricultural Experiment Station

This survey area is in the southwestern part of Oregon (fig. 1). It consists of most of Jackson County and the southwestern part of Klamath County. It borders California to the south. Medford, the largest city in the survey area, is the county seat of Jackson County. Elevation ranges from 970 feet in an area where the Rogue River crosses into Josephine County to nearly 6,600 feet in an area on Hamaker Mountain, in Klamath County.

The total extent of the survey area is 1,585,308 acres. Of this total, 1,352,189 acres is in Jackson County and 233,119 acres is in Klamath County. About 1,042,308 acres is privately owned, and 543,000 acres is publicly owned. About 456,000 acres of the publicly owned land is managed by the Bureau of Land Management, 40,000 acres by the Forest Service, and 7,000 acres by other federal agencies. The remaining 40,000 acres is managed by the State of Oregon or by local governments.

The economy of the survey area is based mainly on forestry, agriculture, manufacturing, tourism, and cattle ranching. The favorable location of the area relative to major transportation corridors facilitates the growth of the economy.

The survey area has more than 110 different kinds of soil. The soils formed in a variety of parent materials. The soils in the Cascade Mountains formed in colluvium and residuum derived from andesite, basalt, tuff, breccia, volcanic ash, and pumice. Those in the Klamath Mountains formed in colluvium and residuum derived from granite, altered igneous and sedimentary rock, and scattered areas of ultramafic rock. The soils in the river valleys and on the adjacent foot slopes formed in alluvium derived from mixed sources.

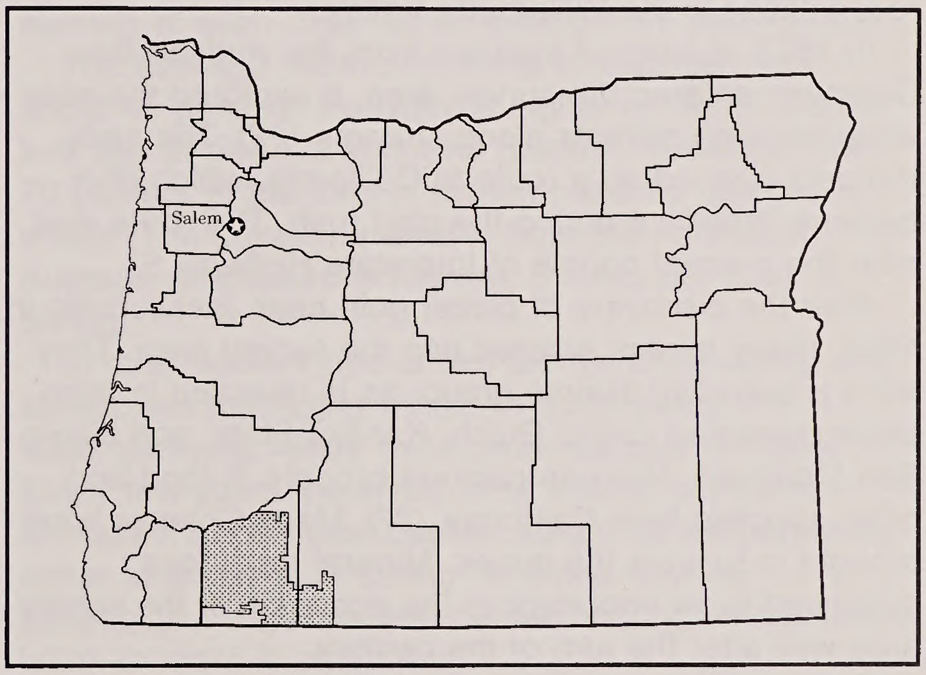

Figure 1.—Location of Jackson County Area in Oregon.

This survey updates soil surveys published in 1969, 1920, and 1913 *(25, 14, 22)*. It provides additional information.

General Nature of the Survey Area

This section gives general information about the survey area. It describes history and development; physiography, relief, and drainage; and climate.

History and Development

Several linguistically distinct Indian tribes inhabited the survey area before the immigration of non-Indian settlers *(8)*. The tribes included the Upland Takilma, the Shasta, the Dakubetede, and the Klamath. The Upland Takilma lived in the upper reaches of the valley of Bear Creek, in the valley of the Rogue River, and in the nearby mountains. The Shasta lived in the valley of Bear Creek, in the Ashland area. The Dakubetede lived in the valley of the Applegate River, near what is now the community of Ruch. The Klamath seasonally hunted and harvested edible plants in the High Cascades.

The Indians occupied semipermanent villages close to sources of food and other needs. They periodically burned some areas in order to increase the growth of edible plants, including huckleberry bushes and browse for big game *(5)*. In the 1850's, there were hostilities between the Indians and miners in the survey area. The armed conflicts drastically reduced the Indian population. Many of those who survived lived on the Table Rock Reservation before they were moved to reservations in the Willamette Valley.

In 1827, a party of trappers from the Hudson Bay Company entered the survey area. It explored the area while trapping animals along streams *(27)*. The early trappers opened up a route to California, which later became important during the gold rush. The route was near the present course of Interstate Highway 5.

After the discovery of placer gold near Jacksonville in 1852, many miners entered into the survey area. They were a culturally diverse group, as is revealed in such place names as China Gulch, Kanaka Flats, and Negro Ben Mountain. Mexican packers brought in food and other supplies from California *(27)*. Many Chinese were brought in to work the mines. Mineral resources continued to be important to the economy of the survey area well after the turn of the century.

Jackson County was established by an act of the Territorial Legislature in 1852. At that time the county included most of the counties that presently make up the southwestern part of Oregon. It was named after General Andrew Jackson. Jacksonville was the first county seat. In 1927, the county seat was moved to Medford.

The industry and population of the survey area expanded following the arrival of the railroad in 1883. By 1900, timber production had replaced mining as the main industry. The timber industry flourished as the means of shipping goods to distant markets improved.

The Klamath River was used to transport logs and lumber downstream. Pokegema, near the banks of the river, was one of the early logging towns established before the turn of the century. Travelers once considered this lumber boomtown the liveliest town between San Francisco and Portland *(6)*. The town suffered a major fire and was never rebuilt.

Hay, cereal crops, and tree fruit were the earliest commercial crops grown in the survey area. The population of Medford doubled between 1910 and 1915 as fruit growers arrived in response to nationwide advertising of the area as an ideal place for the production of tree fruit. The main agricultural products today are tree fruit, especially pears; hay and row crops; and dairy products, beef, and poultry.

The first effort to bring irrigation water to the survey area began in 1905, when the Fish Lake Water Company was established. Irrigation water currently is provided by a system of diversion canals developed by the Medford and Talent Irrigation Districts.

As farming, ranching, and timber harvesting continued, concerns about the use of the land and water resources became important. In response to these concerns, land owners organized the Jackson Soil and Water Conservation District in 1951 and the Rogue Soil and Water Conservation District in 1953. The present Jackson County Soil and Water Conservation District was formed in 1966 through the consolidation of both of these earlier districts.

Demands on the natural resources of the survey area have been intensified by an increase in population, which has more than doubled since the organization of the conservation district. This increase has created new problems of water quality, thereby increasing the complexity of water management and drainage issues.

Tourism is an important part of the economy in the survey area. The major outdoor recreational activities are visiting Crater Lake National Park, hiking the Pacific Crest Trail, river rafting, and fishing. In winter Mt. Ashland offers opportunities for skiing.

Physiography, Relief, and Drainage

The valleys of the Rogue River and Bear Creek, in the central part of the survey area, are characterized by moderate relief. They consist of flood plains, terraces, alluvial fans, and hills, which formed through erosion and the extensive deposition of alluvial outwash following the uplift of the surrounding mountains.

The major drainageways in the survey area are the Rogue, Applegate, and Klamath Rivers and Bear, Evans, Little Butte, Big Butte, Antelope, and Jenny Creeks. Some of these drainageways are in broad, fertile alluvial valleys. Others, such as the Klamath River and Jenny Creek, are entrenched in deeply incised canyons. Most of the streams in the survey area drain into the Rogue River and its tributary, the Applegate River. Most areas of the High Cascades, in

the eastern part of the survey area, are drained by streams flowing generally south into the Klamath River.

East and north of the interior valleys are the Cascade Mountains, which are of volcanic origin. The western flank of the Cascade Mountains is the oldest part of this range. It has been deeply dissected by erosion. It gradually grades into the geologically younger High Cascades, which are characterized by broad plateaus and slopes of moderate relief that have been only slightly modified by erosion.

The Klamath Mountains, in the western part of the survey area, are steep and are characterized by strong relief. They are made up mainly of metamorphic and granitic rock. The metamorphic rock is highly folded and faulted. In many places the granitic rock has intruded into the metamorphic rock and occurs as scattered small bodies throughout the survey area. In areas south of Ashland and near West Evans Creek, in the northwestern part of the survey area, however, the granite occurs as bodies that are several square miles in size. Erosion has modified these geologically old mountains.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

The climate of the survey area is tempered by wind from the Pacific Ocean. Summers are warm. Winters are cool, but snow and freezing temperatures are common only at the higher elevations. In summer rainfall is extremely light. As a result, crops require irrigation. Several weeks often pass without precipitation. Rains are frequent during the rest of the year, especially late in fall and in winter.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Medford, Prospect, and Ruch, Oregon, in the period 1951 to 1979. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature at Medford, Prospect, and Ruch is 39, 38, and 40 degrees F, respectively. The average daily minimum temperature is 31 degrees at Medford, 28 degrees at Prospect, and 30 degrees at Ruch. The lowest temperature on record, which occurred at Prospect on January 22, 1962, is -8 degrees. In summer, the average temperature is 70 degrees at Medford, 65 degrees at prospect, and 68 degrees at Ruch. The average daily maximum temperature is about 86 degrees. The highest recorded temperature, which occurred at Medford on August 8, 1978, is 110 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 20 inches at Medford, 42 inches at Prospect, and 27 inches at Ruch. Of these totals, 20 percent usually falls in April through September. The growing season for most crops usually falls within this period. The heaviest 1-day rainfall during the period of record was 4.39 inches at Prospect on December 22, 1964. Thunderstorms occur on about 9 days each year, and most occur in spring.

The average seasonal snowfall is about 10 inches at Medford, 70 inches at Prospect, and 22 inches at Ruch. The greatest snow depth at any one time during the period of record was 7 inches at Medford, 33 inches at Prospect, and 12 inches at Ruch. On the average, 2 days at Medford, 22 days at prospect, and 5 days at Ruch have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 45 percent. Humidity is higher at night, and the average at dawn is about 85 percent. The sun shines 70 percent of the time in summer and 25 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 6 miles per hour, in spring.

In most winters one or two storms bring strong and sometimes damaging winds. In some years the accompanying heavy rains cause serious flooding. Every few years the invasion of a large continental airmass from the east causes abnormal temperatures either in winter or in spring. In winter several consecutive days are well below freezing. In summer a week or more is sweltering.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil

formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in a pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge gradually into one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of soils in the survey areas.

Survey Procedures

The general procedures followed in making this survey are described in the National Soils Handbook of the Soil Conservation Service. References that were used in the development of the survey were the "Interim Soil Survey Report, Jackson Area, Oregon," published in 1969 *(25)*; mapping of the geomorphic surfaces in the valleys of the Rogue River and Bear Creek by Parsons (unpublished); geologic maps of the Medford Quadrangle, published by the U.S. Geological Survey (USGS) in 1956 and 1982 *(30, 21)*; and the memorandum of understanding between the Soil Conservation Service and the Bureau of Land Management, the Oregon Agricultural Experiment Station, and the Forest Service.

Hillslopes and relief gradients generally were determined through examination of contour intervals on topographic maps. Cultural features and drainageways

were recorded from field observations and through examination of USGS 7½- and 15-minute topographic maps.

The soils in the survey area were mapped according to predictable soil patterns that occur on landforms. The general soil-landform relationships are described in detail in the section "Formation of the Soils." Traverses and transects were used to confirm soil-landform models that were established for various parts of the survey area.

Traverses across the landscape were made so that soil scientists could determine the delineations of the map units and supplement and verify conclusions based on an examination of the tonal patterns on the aerial photographs used to predict the occurrence of different kinds of soil. The traverses were made by truck and on foot. The soil was examined when changes in characteristics were apparent. Where the soils vary considerably, many traverses were made at short intervals.

Transects were made randomly across areas of the map units so that the soil scientists could determine the composition of the dominant and included soils. The soil scientists generally crossed the areas on foot, following a course that had been charted on aerial photographs. The soil characteristics were examined and documented at regular intervals.

The survey area was mapped at two levels of intensity. A higher level was used in mapping alluvial soils and soils on low foothills, which are under intensive agricultural or community development. Maps of flood plains published by the Federal Emergency Management Agency were used as an aid in determining the boundaries of the flood plains. The minimum size of map unit delineations was 5 acres. About 20 percent of the survey area was mapped at this level.

A lower level of intensity was used in mapping gently sloping to steep soils on uplands. These soils formed in various kinds of parent material. They are used for timber production, livestock grazing, or wildlife habitat. The minimum size of the delineations was mainly about 40 acres, but the delineations are as small as 10 acres in areas that are considered to be of extreme importance. About 80 percent of the survey area was mapped at the lower level of intensity.

Spot symbols are used on the maps to identify contrasting kinds of soil and miscellaneous areas that are less than 5 acres in size. Under the heading "Detailed Soil Map Units," contrasting soils or miscellaneous areas that are included in mapping are described if they are of significant extent in a map unit.

The soil mapping in the valleys of the Rogue River and Bear Creek and in some adjacent areas is a revision of the mapping in the survey of the Jackson County area published in 1969 *(25)*. Since that time more has been learned about the soils through laboratory analyses and through examination of data on crop yields and timber site productivity. Previous concepts have been revised because of this improved understanding.

Samples for chemical and physical analyses were taken from typical pedons of the major soils in the survey area. The analyses were made by the Soil Survey Laboratory in Lincoln, Nebraska, and by the laboratory at Oregon State University. The results of the analyses were used in classifying the soils, in determining their fertility and erodibility, and in making various interpretations for engineering, agricultural, and other land uses.

Soil-plant relationships were evaluated in the development of the detailed map unit descriptions included in this survey. Foresters and range conservationists assisted in measuring the potential for timber production at representative forested sites. Soil and range conservationists assisted in collecting crop and forage yield data on farms and in areas of rangeland and in determining the potential productivity of the soils. The data were then correlated with the kind of soil and the site characteristics of the map units. The results were used to predict the performance of the various map units in the survey area.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas making up one unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils or miscellaneous areas can be identified on the map. Likewise, areas that are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The general map units in this survey have been grouped for broad interpretive purposes. Each of the broad groups and the map units in each group are described on the following pages.

Map Unit Descriptions

Soils Formed in Alluvium on Flood Plains, Stream Terraces, and Alluvial Fans

These soils make up about 6 percent of the survey area.

1. Ruch-Medford-Camas

Very deep, well drained, moderately well drained, and excessively drained soils that have a surface layer of gravelly silt loam, silty clay loam, or sandy loam

This map unit is on the flood plains, stream terraces, and alluvial fans along the Applegate River, Bear Creek, the Rogue River, and their tributaries. The vegetation in areas that have not been cultivated is mainly hardwoods or hardwoods and conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 0 to 20 percent. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is about 18 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 125 to 180 days.

This unit makes up about 6 percent of the survey area. It is about 25 percent Ruch soils, 20 percent Medford soils, and 10 percent Camas soils (fig. 2). The remaining 45 percent is Barron, Central Point, Newberg, Evans, Foehlin, Kerby, Shefflein, Takilma, Abin, Coleman, Clawson, Kubli, Cove, and Gregory soils and Dumps and Riverwash. Abin, Cove, Evans, and Newberg soils and Riverwash are on flood plains. Central Point, Coleman, Foehlin, Gregory, Kerby, Kubli, and Takilma soils are on stream terraces. Barron, Clawson, and Shefflein soils are on alluvial fans. They formed in material derived from granitic rock. Dumps are in areas that have been mined.

Ruch soils are on alluvial fans and are well drained. The surface layer is gravelly silt loam. The subsoil is loam.

Medford soils are on stream terraces and are moderately well drained. The surface layer is silty clay loam. The subsoil is silty clay, silty clay loam, and clay loam. The substratum is sandy clay loam.

Camas soils are on flood plains and are excessively drained. The surface layer is sandy loam. The substratum is very gravelly loamy sand and extremely gravelly coarse sand. These soils are frequently flooded.

This unit is used mainly for cultivated crops, hay and pasture, tree fruit, or homesite development. A few areas are used for timber production or wildlife habitat.

This unit is well suited to crops. The main limitations affecting crop production are permeability, wetness in winter and spring, flooding, and seasonal droughtiness. In summer, irrigation is needed for the maximum production of most crops. Sprinkler and trickle irrigation systems are the best methods of applying water, particularly on the sloping parts of the landscape and on soils that have a rapid water intake rate. Unless protected, the Camas soils are poorly suited to crops, hay and pasture, and tree fruit because of the risk of

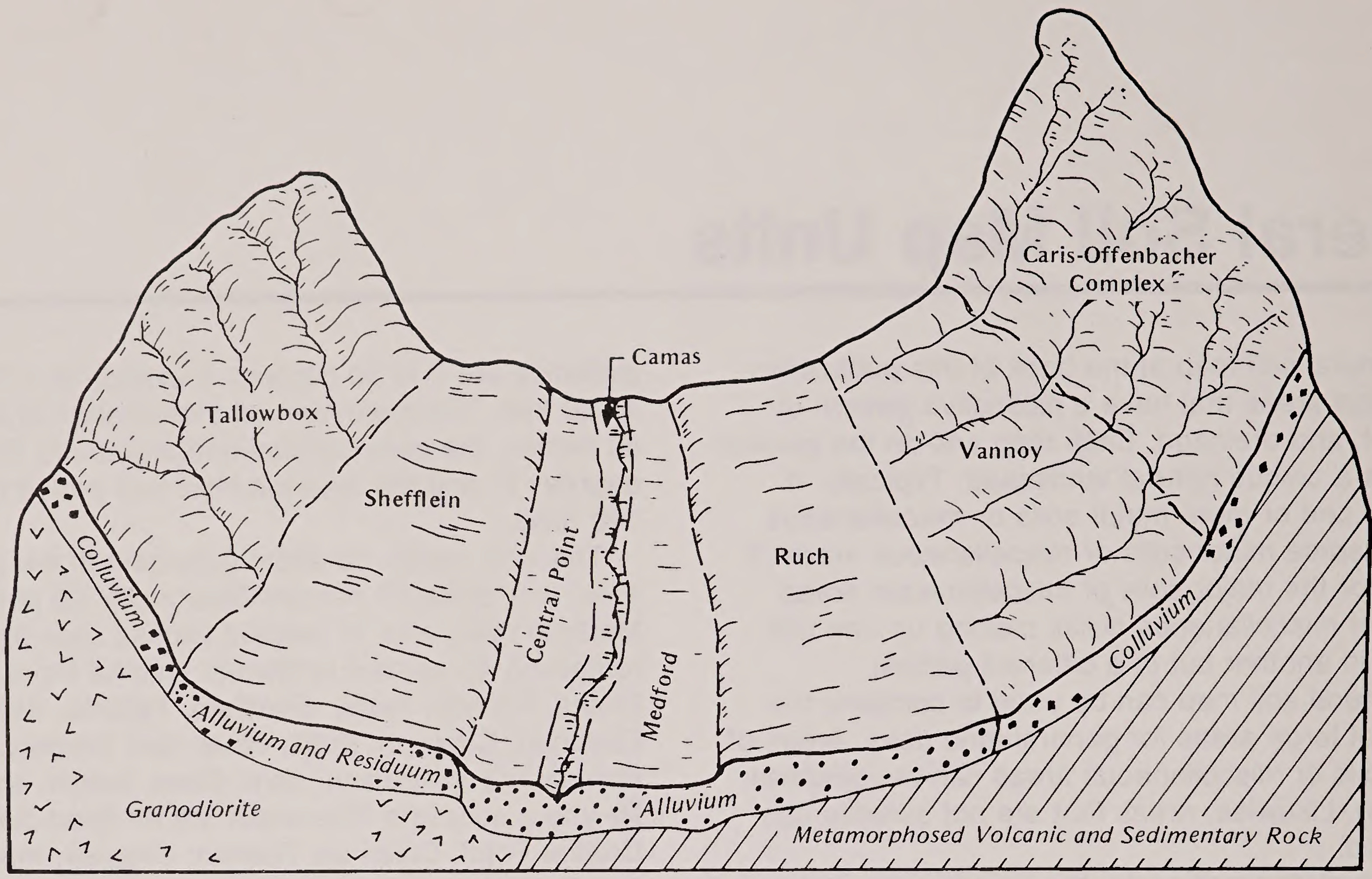

Figure 2.—Typical pattern of soils in the Ruch-Medford-Camas, Tallowbox-Shefflein, and Vannoy-Caris-Offenbacher general map units.

flooding. A subsurface drainage system can lower the water table in the Medford soils if suitable outlets are available.

The main limitations affecting homesite development are moderately slow permeability, wetness, and the shrink-swell potential in areas of the Medford soils and the hazard of flooding and very rapid permeability in areas of the Camas soils. The Ruch soils have few limitations.

Soils Formed in Material Weathered From Sedimentary and Igneous Rock and Mixed Alluvium on Fan Terraces, Ridges, Knolls, Hillslopes, and Alluvial Fans

These soils make up about 10 percent of the survey area.

2. Agate-Winlo-Provig

Well drained and somewhat poorly drained soils that are moderately deep or shallow to a hardpan or are very deep and that have a surface layer of loam, very gravelly clay loam, or very gravelly loam; on fan terraces

This map unit is on fan terraces in the valley of the Rogue River. The native vegetation on the Agate soils is mainly grasses, forbs, and shrubs. That on the Winlo soils is mainly grasses, sedges, rushes, and forbs. That on the Provig soils is mainly hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 0 to 15 percent but range to 35 percent. Elevation is 1,100 to 1,850 feet. The mean annual precipitation is about 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 150 to 180 days.

This unit makes up about 2 percent of the survey area. It is about 45 percent Agate soils, 25 percent Winlo soils, and 10 percent Provig soils. The remaining 20 percent is Brader and Debenger soils on low knolls; Abin, Medford, and Cove soils in drainageways; Coker and Padigan soils on concave slopes; and Carney soils.

Agate, Winlo, and Provig soils formed in poorly sorted, gravelly old stream alluvium.

Agate soils are moderately deep to a hardpan and are well drained. The surface layer is loam. The subsoil is clay loam over a hardpan. The substratum is extremely gravelly coarse sandy loam.

Winlo soils are shallow to a hardpan and are somewhat poorly drained. The surface layer is very gravelly clay loam. The subsoil is very gravelly clay

over a hardpan. The substratum is extremely gravelly coarse sandy loam.

Provig soils are very deep and well drained. The surface layer is very gravelly loam. The subsoil is very gravelly clay loam. The substratum is extremely gravelly clay, extremely gravelly clay loam, and extremely gravelly sandy loam.

This unit is used mainly for hay and pasture, homesite development, livestock grazing, or wildlife habitat.

The main limitations in the areas used for hay and pasture or for livestock grazing are wetness in winter and spring, droughtiness in summer and fall, compaction, the depth to a hardpan in the Agate and Winlo soils, and the very gravelly surface layer in the Winlo and Provig soils. The Winlo soils remain wet for long periods in spring. If possible, grazing should be delayed until the soils are firm enough to withstand trampling by livestock. The use of ground equipment is limited in many areas by gravel and cobbles on the surface of the Winlo soils. In summer, irrigation is needed for maximum forage production. Because of the hardpan, overirrigation can result in a perched water table.

The main limitations affecting homesite development are wetness, the depth to a hardpan, slow permeability, and a high shrink-swell potential. The slope also is a major limitation in some areas. These soils are poorly suited to standard systems of onsite waste disposal because of wetness and the depth to a hardpan in the Winlo soils, the depth to a hardpan in the Agate soils, and slow permeability of the Provig soils.

3. Brader-Debenger-Langellain

Shallow and moderately deep, well drained and moderately well drained soils that have a surface layer of loam; on ridges and knolls

The native vegetation on this map unit is mainly hardwoods and some conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 40 percent. Elevation is 1,000 to 3,500 feet. The mean annual precipitation is about 18 to 40 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 130 to 180 days.

This unit makes up about 2 percent of the survey area. It is about 35 percent Brader soils, 20 percent Debenger soils, and 15 percent Langellain soils. The remaining 30 percent is Shefflein soils on alluvial fans; Kerby, Medford, and Gregory soils on stream terraces; and Carney, Selmac, and Coker soils on concave slopes.

Brader and Debenger soils formed in colluvium derived from sedimentary rock. Langellain soils formed in colluvium and alluvium derived from sedimentary rock.

Brader soils are shallow and well drained. The surface layer and subsoil are loam.

Debenger soils are moderately deep and well drained. The surface layer is loam. The subsoil is clay loam.

Langellain soils are moderately deep and moderately well drained. The surface layer is loam. The subsoil is clay.

This unit is used mainly for hay and pasture or for livestock grazing. A few areas are used for homesite development or wildlife habitat.

The main limitations in the areas used for hay and pasture or for livestock grazing are wetness in winter and spring, the depth to bedrock, restricted permeability, droughtiness, and compaction. The slope also is a major limitation in some areas. The Langellain soils remain wet for long periods in spring. Grazing should be delayed until the soils are firm enough to withstand trampling by livestock. In summer, irrigation is needed for maximum forage production. Because of the layer of clay in the Langellain soils and the depth to bedrock in the Brader soils, overirrigation can result in a perched water table.

The main limitations affecting homesite development are wetness, a high shrink-swell potential, and the depth to bedrock. The slope also is a major limitation in some areas.

4. Carney-Coker

Moderately deep and very deep, moderately well drained and somewhat poorly drained soils that have a surface layer of clay or cobbly clay; on alluvial fans and hillslopes

The native vegetation on the Carney soils in this map unit is mainly scattered hardwoods and an understory of grasses, shrubs, and forbs. That on the Coker soils is mainly grasses, sedges, and forbs. Slopes generally are 0 to 35 percent. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is about 18 to 35 inches, the mean annual temperature is 45 to 54 degrees F, and the average frost-free period is 120 to 180 days.

This unit makes up about 6 percent of the survey area. It is about 55 percent Carney soils and 10 percent Coker soils. The remaining 35 percent is Brader and Debenger soils on knolls; Heppsie and McMullin soils on hillslopes; Padigan and Phoenix soils on concave slopes; Cove soils in drainageways; and Darow, Medco, and Tablerock soils.

Carney soils formed in alluvium and colluvium derived from igneous rock. Coker soils formed in clayey alluvium derived from igneous rock.

Carney soils are moderately deep and moderately

well drained. The surface layer is clay or cobbly clay. The subsoil is clay.

Coker soils are very deep and somewhat poorly drained. The surface layer and subsoil are clay.

This unit is used mainly for tree fruit, hay and pasture, homesite development, livestock grazing, or wildlife habitat.

The main limitations in the areas used for hay and pasture or for tree fruit are the high content of clay, a slow rate of water intake, wetness in winter and spring, droughtiness in summer and fall, and the slope. The Coker soils remain wet for long periods in spring. Grazing should be delayed until the soils are firm enough to withstand trampling by livestock. In summer, irrigation is needed for the maximum production of forage crops and tree fruit. Because of very slow permeability, water applications should be regulated so that the water does not stand on the surface and damage the crops. Because of the slope in some areas, sprinkler and trickle irrigation systems are the best methods of applying water. The high content of clay severely limits tillage. The soils are well suited to permanent pasture.

The main limitations affecting homesite development are very slow permeability, a high shrink-swell potential, the depth to bedrock, low strength, and wetness. The slope also is a major limitation in some areas. These soils are poorly suited to standard systems of onsite waste disposal because of the very slow permeability and depth to bedrock in the Carney soils and the very slow permeability and wetness in the Coker soils. Properly designing the foundations and footings of buildings helps to prevent the structural damage caused by shrinking and swelling.

The more sloping areas of this unit are used for livestock grazing. The main limitations affecting livestock grazing are compaction, erosion, droughtiness, and the slope.

Soils Formed in Material Weathered From Granodiorite on Alluvial Fans, Ridges, and Hillslopes.

These soils make up about 5 percent of the survey area.

5. Tallowbox-Shefflein

Moderately deep and deep, somewhat excessively drained and well drained soils that have a surface layer of gravelly sandy loam or loam and receive 25 to 40 inches of annual precipitation

This map unit is on hillslopes, ridges, and alluvial fans. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 2 to 70 percent. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is about 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 3 percent of the survey area. It is about 55 percent Tallowbox soils and 30 percent Shefflein soils (fig. 2). The remaining 15 percent is Barron soils on alluvial fans, Clawson soils on concave slopes, and Rogue soils at elevations of more than 4,000 feet.

Tallowbox soils are moderately deep and somewhat excessively drained. The surface layer and subsoil are gravelly sandy loam.

Shefflein soils are deep and well drained. The surface layer is loam. The subsoil is clay loam and sandy clay loam.

This unit is used mainly for timber production or wildlife habitat. A few of the more gently sloping areas of the Shefflein soils are used for hay and pasture or for homesite development.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Management that minimizes erosion is essential when timber is harvested. Site preparation is needed to ensure adequate reforestation. High-lead or other cable logging systems should be used on the steeper slopes.

Irrigation is needed in the areas used for hay and pasture. Sprinkler irrigation is the best method of applying water. This method helps to prevent excessive runoff and minimizes the risk of erosion.

The Shefflein soils are well suited to homesite development. The main limitation is moderately slow permeability.

6. Wolfpeak-Tethrick-Siskiyou

Very deep and moderately deep, well drained and somewhat excessively drained soils that have a surface layer of sandy loam or gravelly sandy loam and receive 40 to 50 inches of annual precipitation

This map unit is on hillslopes, ridges, and old slump benches. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 3 to 75 percent. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is about 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 1 percent of the survey area. It is about 25 percent Wolfpeak soils, 25 percent Tethrick soils, and 25 percent Siskiyou soils. The

remaining 25 percent is Beekman and Colestine soils on steep hillslopes; Josephine and Pollard soils on gently sloping hillslopes and on concave slopes; and Goolaway, Musty, and Speaker soils.

Wolfpeak soils are very deep and well drained. The surface layer is sandy loam. The subsoil is clay loam.

Tethrick soils are very deep and well drained. The surface layer, subsoil, and substratum are sandy loam.

Siskiyou soils are moderately deep and somewhat excessively drained. The surface layer is gravelly sandy loam. The subsoil and substratum are sandy loam.

This unit is used mainly for timber production or wildlife habitat. A few of the more gently sloping areas of the Wolfpeak soils are used for hay and pasture or for homesite development.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Management that minimizes erosion is essential when timber is harvested. Site preparation is needed to ensure adequate reforestation. High-lead or other cable logging systems should be used on the steeper slopes.

Irrigation is needed in the areas used for hay and pasture. Sprinkler irrigation is the best method of applying water. This method helps to prevent excessive runoff and minimizes the risk of erosion.

The Wolfpeak soils are well suited to homesite development. The main limitation is moderately slow permeability.

7. Steinmetz-Lettia

Very deep and deep, somewhat excessively drained and well drained soils that have a surface layer of sandy loam and receive 45 to 60 inches of precipitation

This map unit is on hillslopes and old slump benches. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 12 to 75 percent. Elevation is 1,800 to 4,000 feet. The mean annual precipitation is about 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 1 percent of the survey area. It is about 50 percent Steinmetz soils and 25 percent Lettia soils (fig. 3). The remaining 25 percent is Acker and Dumont soils on gently sloping hillslopes and on concave slopes; Atring and Kanid soils on steep hillslopes; Dubakella, Gravecreek, and Pearsoll soils, which formed in material derived from serpentinitic rock; Goolaway, Musty, and Norling soils; and Rogue soils at elevations of more than 4,000 feet.

Steinmetz soils are very deep and somewhat excessively drained. The surface layer and subsoil are sandy loam.

Lettia soils are deep and well drained. The surface layer is sandy loam. The subsoil is clay loam and loam. The substratum is loam.

This unit is used mainly for timber production or wildlife habitat. The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Management that minimizes erosion is essential when timber is harvested. Site preparation is needed to ensure adequate reforestation. High-lead or other cable logging systems should be used on the steeper slopes.

Soils Formed in Material Weathered From Igneous Rock on Plateaus and Hillslopes

These soils make up about 40 percent of the survey area.

8. Freezener-Geppert

Very deep and moderately deep, well drained soils that have a surface layer of gravelly loam or very cobbly loam

This map unit is on plateaus and hillslopes. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 70 percent. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is about 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 5 percent of the survey area. It is about 65 percent Freezener soils and 30 percent Geppert soils. The remaining 5 percent is McMullin soils on ridges and steep hillslopes and Terrabella soils on concave slopes and near drainageways.

Freezener soils are very deep. The surface layer is gravelly loam. The subsoil is clay loam and clay.

Geppert soils are moderately deep. The surface layer is very cobbly loam. The subsoil is extremely cobbly clay loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat. A few areas are used for hay and pasture.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Geppert soils increases the seedling mortality rate. High-lead or other cable

logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

9. Straight-Freezener-Shippa

Moderately deep, very deep, and shallow, well drained soils that have a surface layer of extremely gravelly loam or gravelly loam

This map unit is on hillslopes and plateaus. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 70 percent. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is about 35 to 55 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 4 percent of the survey area. It is about 30 percent Straight soils, 25 percent Freezener soils, and 10 percent Shippa soils. The remaining 35 percent is McMullin soils on ridges and steep hillslopes, Takilma soils in drainageways, Geppert and McNull soils, Medco soils on gently sloping hillslopes and on concave slopes, and Terrabella soils on concave slopes and near drainageways.

Straight soils are moderately deep. The surface layer is extremely gravelly loam. The subsoil is very gravelly loam and very cobbly clay loam.

Freezener soils are very deep. The surface layer is gravelly loam. The subsoil is clay loam and clay.

Shippa soils are shallow. The surface layer is extremely gravelly loam. The subsoil is extremely cobbly loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, plant competition, the slope, and the depth to bedrock in the Shippa soils. Seedling mortality also is a major management concern, particularly on south-facing slopes. Site preparation is needed to ensure optimum reforestation. The large number of rock fragments in the soils and the depth to bedrock in the Shippa soils increase the seedling

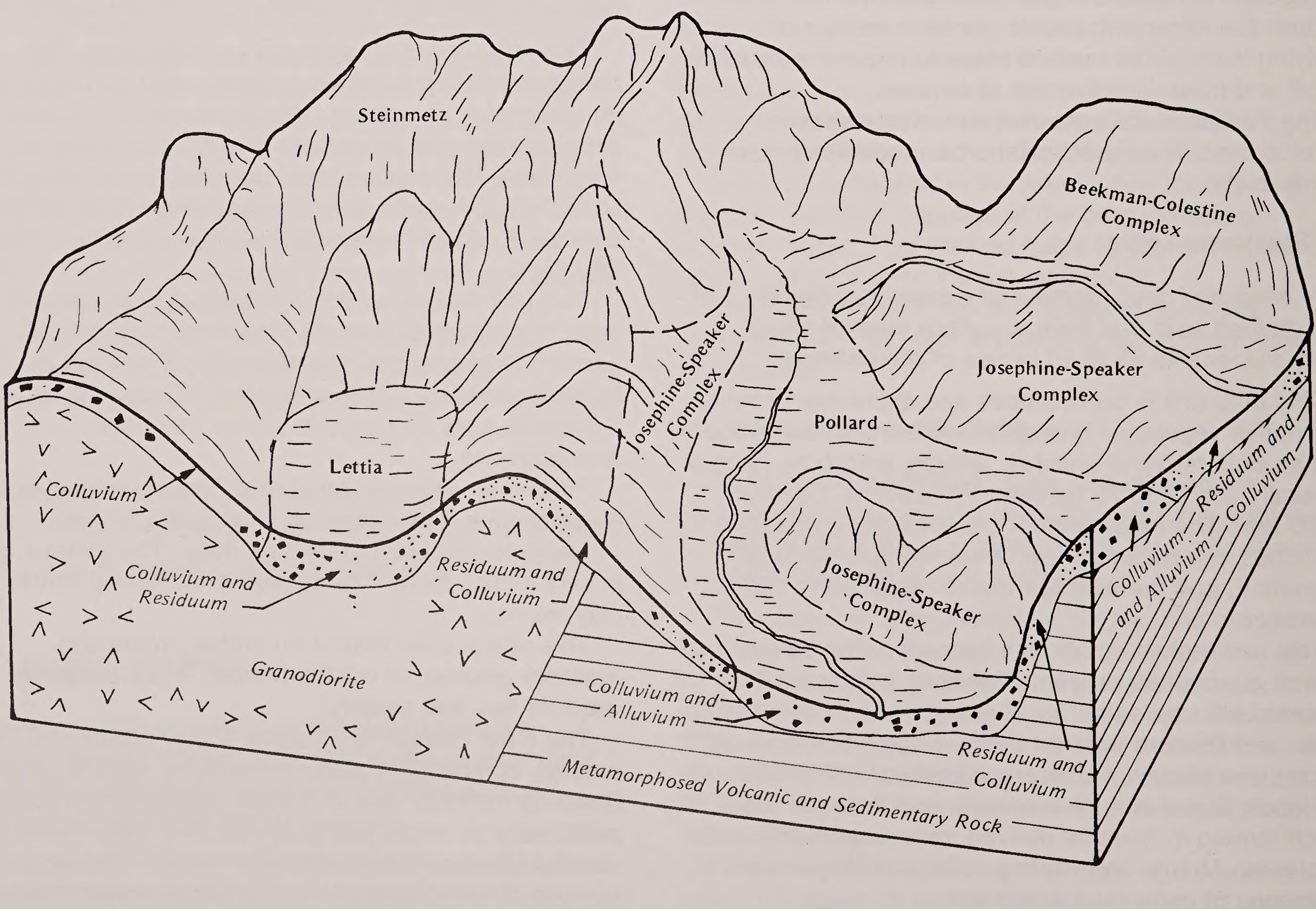

Figure 3.—Typical pattern of soils in the Steinmetz-Lettia and Josephine-Beekman-Speaker general map units.

mortality rate. High-lead or other cable logging systems should be used on the steeper slopes. Windthrow is a hazard on the Shippa soils because of the limited depth to bedrock, which restricts the rooting depth.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

10. Dumont-Coyata

Very deep and moderately deep, well drained soils that have a surface layer of gravelly loam

This map unit is on plateaus and hillslopes. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 80 percent. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is about 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 3 percent of the survey area. It is about 40 percent Dumont soils and 30 percent Coyata soils. The remaining 30 percent is Reinecke soils on nearly level plateaus, Donegan and Killet soils at elevations of more than 4,000 feet, and Sibannac and Terrabella soils on concave slopes and near drainageways.

Dumont soils are very deep. The surface layer is gravelly loam. The subsoil is clay.

Coyata soils are moderately deep. The surface layer is gravelly loam. The subsoil is very cobbly and extremely cobbly clay loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Coyata soils increases the seedling mortality rate. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

11. Medco-McMullin

Moderately deep and shallow, moderately well drained and well drained soils that have a surface layer of cobbly clay loam or gravelly loam

This map unit is on hillslopes. The native vegetation on the Medco soils is mainly hardwoods, a few scattered conifers, and an understory of grasses, shrubs, and forbs. That on the McMullin soils is mainly grasses, shrubs, and forbs. Slopes generally are 3 to 60 percent. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is about 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 8 percent of the survey area. It is about 40 percent Medco soils and 35 percent McMullin soils. The remaining 25 percent is Heppsie soils on steep hillslopes, McNull and Carney soils, Coker soils on concave slopes, and Rock outcrop.

Medco soils are moderately deep and moderately well drained. The surface layer is cobbly clay loam. The subsoil is clay.

McMullin soils are shallow and well drained. The surface layer is gravelly loam. The subsoil is gravelly clay loam.

This unit is used mainly for livestock grazing or wildlife habitat. A few of the more gently sloping areas of the Medco soils are used for hay and pasture. A few areas of the Medco soils that receive enough precipitation are used for timber production.

The main limitations affecting livestock grazing are compaction, erosion, the depth to bedrock, droughtiness, seasonal wetness, the Rock outcrop, stones and cobbles on the surface, and the slope. The use of ground equipment generally is not practical on the McMullin soils because of the stones on the surface, the Rock outcrop, and the slope. The Rock outcrop and the slope also limit access by livestock in some areas. The Medco soils remain wet for long periods in spring. Grazing should be delayed until the soils are firm enough to withstand trampling by livestock.

The main limitations in the areas used for hay and pasture are wetness in winter and spring, droughtiness in summer and fall, and very slow permeability in the subsoil. In summer, irrigation is needed for maximum forage production.

The main limitations affecting timber production are erosion, compaction, slumping, seasonal wetness, and plant competition. Seedling mortality also is a major management concern, particularly on south-facing slopes.

12. Skookum-McMullin-Rock outcrop

Rock outcrop and moderately deep and shallow, well drained soils that have a surface layer of very cobbly loam or gravelly loam

This map unit is on hillslopes and plateaus. The native vegetation on the Skookum soils is mainly hardwoods, scattered conifers, and an understory of grasses, shrubs, and forbs. That on the McMullin soils is mainly grasses, shrubs, and forbs. Slopes generally

are 1 to 70 percent. Elevation is 2,800 to 4,800 feet. The mean annual precipitation is about 18 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days.

This unit makes up about 1 percent of the survey area. It is about 35 percent Skookum soils, 20 percent McMullin soils, and 20 percent Rock outcrop. The remaining 25 percent is Bogus soils on forested, north-facing slopes; Shoat soils on mounds in areas of patterned ground; Randcore soils between the mounds in areas of patterned ground; Carney soils on concave slopes; and Heppsie and Lorella soils.

Skookum soils are moderately deep. The surface layer is very cobbly loam. The subsoil is very cobbly clay loam, very cobbly clay, and extremely cobbly clay.

McMullin soils are shallow. The surface layer is gravelly loam. The subsoil is gravelly clay loam.

Rock outcrop consists of areas of exposed bedrock.

This unit is used mainly for livestock grazing or wildlife habitat. The main limitations affecting livestock grazing are compaction, erosion, the Rock outcrop, cobbles and stones on the surface, droughtiness, the depth to bedrock, and the slope. The use of ground equipment is not practical because of the cobbles and stones on the surface, the Rock outcrop, and the slope. The Rock outcrop and the slope also limit access by livestock in some areas. The suitability of this unit for range seeding is limited by the depth to bedrock in the McMullin soils, droughtiness, and the Rock outcrop.

13. McNull-McMullin-Medco

Moderately deep and shallow, well drained and moderately well drained soils that have a surface layer of loam, gravelly loam, or cobbly clay loam

The map unit is on hillslopes. The native vegetation on the McNull and Medco soils is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. That on the McMullin soils is mainly grasses, shrubs, and forbs. Slopes generally are 12 to 60 percent. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is about 25 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 8 percent of the survey area. It is about 45 percent McNull soils, 20 percent McMullin soils, and 20 percent Medco soils. The remaining 15 percent is Coker soils on concave slopes, Carney soils, and Rock outcrop.

McNull soils are moderately deep and well drained. The surface layer is loam. The subsoil is clay loam and cobbly clay.

McMullin soils are shallow and well drained. The surface layer is gravelly loam. The subsoil is gravelly clay loam.

Medco soils are moderately deep and moderately well drained. The surface layer is cobbly clay loam. The subsoil is clay.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat. The McNull and Medco soils are used mainly for timber production or livestock grazing. The McMullin soils are used for livestock grazing.

The main limitations affecting timber production are erosion, compaction, slumping, plant competition, seasonal wetness, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Site preparation is needed to ensure adequate reforestation. The Medco soils are subject to slumping. Road failure and landslides are likely to occur after road construction or clearcutting. The seasonal water table in the Medco soils restricts the use of equipment. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, the depth to bedrock, droughtiness, the Rock outcrop, stones and cobbles on the surface, seasonal wetness, and the slope. The use of ground equipment generally is not practical on the McMullin soils because of the stones on the surface, the Rock outcrop, and the slope. The Rock outcrop and the slope also limit access by livestock in some areas. The Medco soils remain wet for long periods in spring. Grazing should be delayed until the soils are firm enough to withstand trampling by livestock.

14. Tatouche-Bybee

Very deep, well drained and somewhat poorly drained soils that have a surface layer of gravelly loam or loam

This map unit is on hillslopes and plateaus. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 65 percent. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is about 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days.

This unit makes up about 3 percent of the survey area. It is about 45 percent Tatouche soils and 30 percent Bybee soils. The remaining 25 percent is Farva, Hobit, and Pinehurst soils; Woodseye soils on ridges and convex slopes; Kanutchan and Sibannac soils on concave slopes and near drainageways; and Rock outcrop.

Tatouche soils are well drained. The surface layer is gravelly loam. The subsoil is gravelly clay loam and clay.

Bybee soils are somewhat poorly drained. The surface layer is loam. The subsoil and substratum are clay.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, slumping, plant competition, seasonal wetness, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. Site preparation is needed to ensure adequate reforestation. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. The Bybee soils are subject to slumping. Road failure and landslides are likely to occur on these soils after road construction or clearcutting. The seasonal high water table in the Bybee soils restricts the use of equipment. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

15. Oatman-Otwin

Very deep and moderately deep, well drained soils that have a surface layer of cobbly loam or stony sandy loam

This map unit is on plateaus and hillslopes. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 0 to 65 percent. Elevation is 4,800 to 6,600 feet. The mean annual precipitation is about 30 to 40 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days.

This unit makes up about 2 percent of the survey area. It is about 75 percent Oatman soils and 10 percent Otwin soils. The remaining 15 percent is Hoxie and Klamath soils on concave slopes and near drainageways.

Oatman soils are very deep. The surface layer is cobbly loam. The subsoil and substratum are very cobbly sandy loam.

Otwin soils are moderately deep. The surface layer is stony sandy loam. The subsoil is very cobbly sandy loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the soils increases the seedling mortality rate. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

16. Rustlerpeak-Farva

Moderately deep, well drained soils that have a surface layer of gravelly loam or very cobbly loam

This map unit is on plateaus and hillslopes. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 3 to 70 percent. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is about 40 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days.

This unit makes up about 1 percent of the survey area. It is about 40 percent Rustlerpeak soils and 35 percent Farva soils. The remaining 25 percent is Woodseye soils on ridges and convex slopes; Hobit, Pinehurst, and Snowlin soils; Sibannac soils on concave slopes and near drainageways; and Rock outcrop.

Rustlerpeak soils have a surface layer of gravelly loam. The subsoil is very cobbly clay loam.

Farva soils have a surface layer of very cobbly loam. The subsoil and substratum are extremely cobbly loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the soils increases the seedling mortality rate. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

17. Farva-Pinehurst

Moderately deep and very deep, well drained soils that have a surface layer of very cobbly loam or loam

This map unit is on plateaus and hillslopes. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 3 to 70 percent. Elevation is 3,600 to 5,500 feet. The mean

annual precipitation is about 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days.

This unit makes up about 5 percent of the survey area. It is about 65 percent Farva soils and 20 percent Pinehurst soils. The remaining 15 percent is Woodseye soils on ridges and convex slopes, Tatouche soils, Bybee and Kanutchan soils on concave slopes, Sibannac soils on concave slopes and near drainageways, and Rock outcrop.

Farva soils are moderately deep. The surface layer is very cobbly loam. The subsoil and substratum are extremely cobbly loam.

Pinehurst soils are very deep. The surface layer is loam. The subsoil is clay loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Farva soils increases the seedling mortality rate. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

Soils Formed in Material Weathered From Altered Sedimentary and Igneous Rock on Ridges and Hillslopes

These soils make up about 23 percent of the survey area.

18. Acker-Norling-Kanid

Very deep, moderately deep, and deep, well drained soils that have a surface layer of gravelly loam or very gravelly loam

This map unit is on hillslopes. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 12 to 80 percent. Elevation is 2,400 to 4,100 feet. The mean annual precipitation is about 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 1 percent of the survey area. It is about 30 percent Acker soils, 20 percent Norling soils, and 15 percent Kanid soils. The remaining 35 percent is Abegg soils on alluvial fans; Dumont soils on concave slopes and gently sloping hillslopes; Atring soils on steep hillslopes; Dubakella, Gravecreek, and Pearsoll soils, which formed in material derived from serpentinitic rock; Jayar soils at elevations of more than 4,000 feet; and Jayar Variant soils at elevations of more than 4,700 feet.

Acker soils are very deep. The surface layer is gravelly loam. The subsoil is gravelly clay loam.

Norling soils are moderately deep. The surface layer is very gravelly loam. The subsoil is gravelly and very cobbly clay loam.

Kanid soils are deep. The surface layer is very gravelly loam. The subsoil is very gravelly clay loam.

This unit is used mainly for timber production or wildlife habitat. The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Kanid soils increases the seedling mortality rate. High-lead or other cable logging systems should be used on the steeper slopes.

19. Josephine-Beekman-Speaker

Deep and moderately deep, well drained soils that have a surface layer of gravelly loam or loam

This map unit is on hillslopes. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 12 to 80 percent. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is about 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 5 percent of the survey area. It is about 30 percent Josephine soils, 20 percent Beekman soils, and 20 percent Speaker soils (fig. 3). The remaining 30 percent is Camas, Evans, and Newberg soils on flood plains; Abegg and Pollard soils on alluvial fans and concave slopes; McMullin soils on ridges and steep hillslopes; Dubakella and Pearsoll soils, which formed in material derived from serpentinitic rock; and Colestine soils on steep hillslopes.

Josephine soils are deep. The surface layer is gravelly loam. The subsoil is gravelly clay loam.

Beekman soils are moderately deep. The surface layer is gravelly loam. The subsoil is extremely gravelly loam.

Speaker soils are moderately deep. The surface layer is loam. The subsoil is loam and gravelly clay loam.

This unit is used mainly for timber production or wildlife habitat. The main limitations affecting timber

production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Beekman soils increases the seedling mortality rate. High-lead or other cable logging systems should be used on the steeper slopes.

20. Vannoy-Caris-Offenbacher

Moderately deep, well drained soils that have a surface layer of silt loam or gravelly loam

This map unit is on hillslopes. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 12 to 80 percent. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is about 20 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 15 percent of the survey area. It is about 35 percent Vannoy soils, 25 percent Caris soils, and 10 percent Offenbacher soils (fig. 2). The remaining 30 percent is Camas, Evans, and Newberg soils on flood plains; Abegg and Ruch soils on alluvial fans; Selmac soils on concave slopes; Manita and Shefflein soils on alluvial fans and gently sloping hillslopes; Dubakella soils, which formed in material derived from serpentinitic rock; McMullin soils on ridges and steep hillslopes; Tallowbox and Voorhies soils; and Jayar soils at elevations of more than 4,000 feet.

Vannoy soils have a surface layer of silt loam. The subsoil is clay loam, gravelly clay loam, and extremely gravelly clay loam.

Caris soils have a surface layer of gravelly loam. The subsoil is very gravelly clay loam and extremely gravelly loam.

Offenbacher soils have a surface layer of gravelly loam. The subsoil is loam.

This unit is used mainly for timber production or wildlife habitat. A few of the more gently sloping areas of the Vannoy soils are used for pasture or homesite development.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Caris soils increases the seedling mortality rate. High-lead or other cable logging systems should be used on the steeper slopes.

Irrigation can increase forage production on the Vannoy soils. The water supply, however, is limited.

The main limitations affecting homesite development on the Vannoy soils are the depth to bedrock, the slope, moderately slow permeability, and low strength.

21. Goolaway-Beekman-Musty

Moderately deep, well drained soils that have a surface layer of silt loam or gravelly loam

This map unit is on ridges and hillsides. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 12 to 80 percent. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is about 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 2 percent of the survey area. It is about 25 percent Goolaway soils, 20 percent Beekman soils, and 10 percent Musty soils. The remaining 45 percent is Colestine soils on steep hillslopes; Pollard and Wolfpeak soils on concave slopes; Josephine, Speaker, Tethrick, and Steinmetz soils; and Snowbrier soils at elevations of more than 3,600 feet.

Goolaway soils have a surface layer and subsoil of silt loam.

Beekman soils have a surface layer of gravelly loam. The subsoil is extremely gravelly loam.

Musty soils have a surface layer of gravelly loam. The subsoil is very cobbly loam.

This unit is used mainly for timber production or wildlife habitat. The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. The hazard of erosion is high. Management that minimizes erosion is essential when timber is harvested. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Beekman and Musty soils increases the seedling mortality rate. High-lead or other cable logging systems should be used on the steeper slopes.

Soils Formed in Material Weathered From Pyroclastics and Igneous Rock on Plateaus and Hillslopes

These soils make up about 16 percent of the survey area.

22. Hukill-Geppert

Deep and moderately deep, well drained soils that are gravelly loam in the upper part of the surface layer or have a surface layer of very cobbly loam

This map unit is on plateaus and hillslopes. The native vegetation is mainly conifers and hardwoods and

an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 35 percent but are as much as 70 percent. Elevation is 2,000 to 3,000 feet. The mean annual precipitation is about 30 to 45 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 1 percent of the survey area. It is about 70 percent Hukill soils and 10 percent Geppert soils. The remaining 20 percent is Terrabella soils on concave slopes and Freezener soils.

Hukill soils are deep. The upper part of the surface layer is gravelly loam, and the lower part is gravelly clay loam. The subsoil is gravelly clay loam and gravelly clay.

Geppert soils are moderately deep. The surface layer is very cobbly loam. The subsoil is extremely cobbly clay loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are compaction and plant competition on the Hukill soils and erosion, compaction, plant competition, and seedling mortality on the Geppert soils. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Geppert soils increases the seedling mortality rate. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction.

The main limitation affecting livestock grazing is compaction.

23. Crater Lake-Alcot-Barhiskey

Very deep, well drained, somewhat excessively drained, and excessively drained soils that have a surface layer of sandy loam, gravelly sandy loam, or gravelly loamy sand

This map unit is on plateaus, hillslopes, and outwash plains. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 0 to 35 percent but are as much as 70 percent. Elevation is 2,000 to 3,200 feet. The mean annual precipitation is about 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days.

This unit makes up about 1 percent of the survey area. It is about 35 percent Crater Lake soils, 20 percent Alcot soils, and 20 percent Barhiskey soils (fig. 4). The remaining 25 percent is Sibannac soils near drainageways and Barhiskey Variant, Coyata, Dumont, and Reinecke soils.

Crater Lake soils are well drained. The surface layer, subsoil, and substratum are sandy loam.

Alcot soils are somewhat excessively drained. The surface layer and subsoil are gravelly sandy loam. The substratum is very cobbly sandy loam.

Barhiskey soils are excessively drained. The surface layer is gravelly loamy sand. The substratum is gravelly sand.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat. A few areas are used for hay and pasture or for homesite development.

The main limitations affecting timber production are compaction, erosion, soil displacement, and plant competition. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. Site preparation is needed to ensure adequate reforestation. The sandy texture and low available water capacity of the Barhiskey soils increase the seedling mortality rate. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. Displacement of the surface layer occurs most readily when the soils are dry. Compaction of the Crater Lake and Alcot soils can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction.

The main limitations affecting livestock grazing are compaction, soil displacement, and erosion.

The main limitations affecting homesite development are very rapid or rapid permeability, a high content of volcanic ash and pumice in the Crater Lake and Alcot soils, and a high content of sand in the Barhiskey soils.

24. Pokegema-Woodcock

Deep and very deep, well drained soils that are loam or stony loam in the upper part of the surface layer

This map unit is on hillslopes and plateaus. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 55 percent. Elevation is 3,800 to 6,600 feet. The mean annual precipitation is about 25 to 35 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days.

This unit makes up about 9 percent of the survey area. It is about 50 percent Pokegema soils and 35 percent Woodcock soils. The remaining 15 percent is Klamath soils on concave slopes and near drainageways and Aspenlake and Whiteface soils on alluvial fans.

Pokegema soils are deep. The upper part of the surface layer is loam, and the lower part is clay loam. The subsoil and substratum are gravelly clay.

Woodcock soils are very deep. The upper part of the surface layer is stony loam, and the lower part is very gravelly loam. The subsoil is very gravelly clay loam.

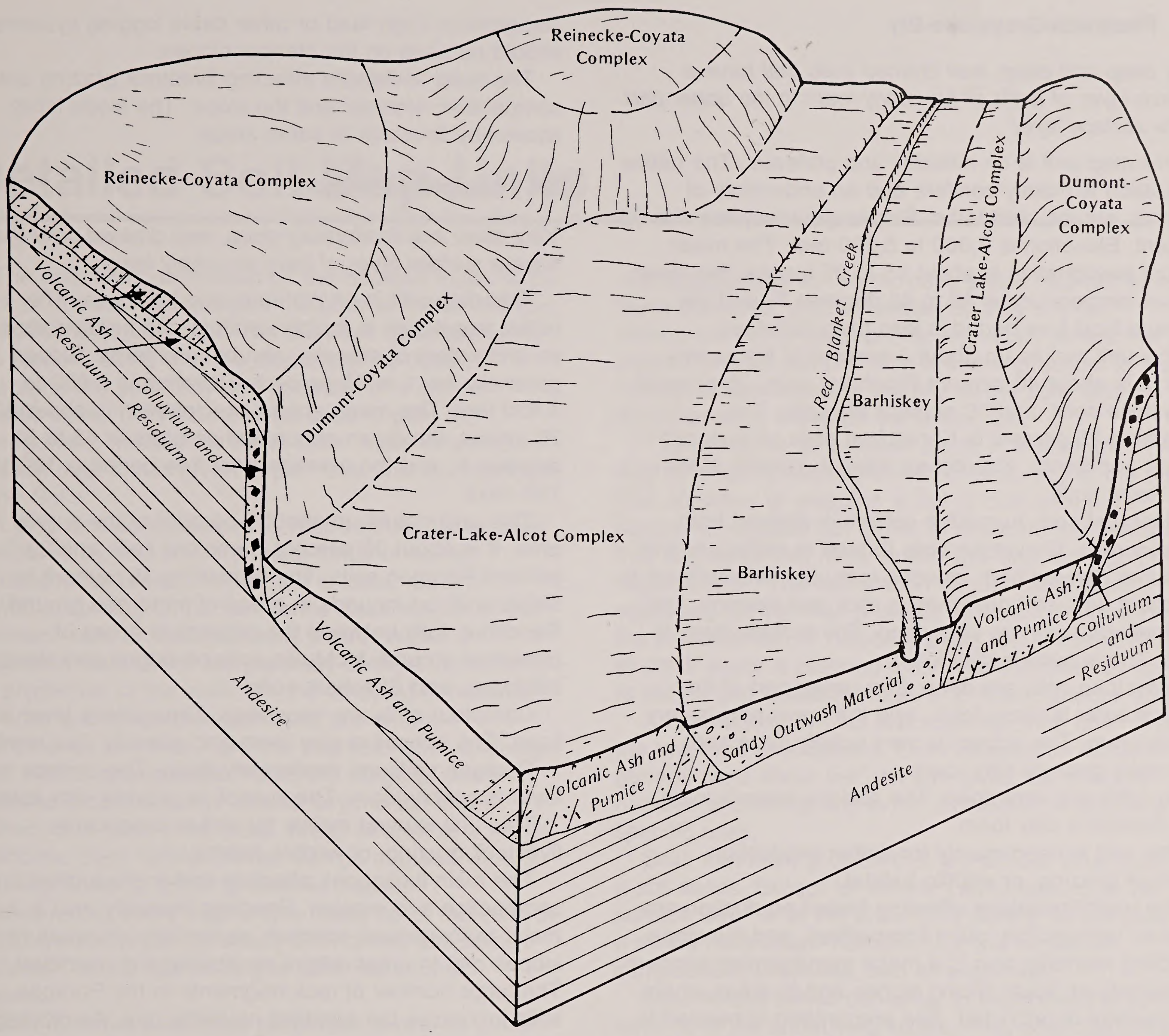

Figure 4.—Typical pattern of soils in the Crater Lake-Alcot-Barhiskey general map unit.

The substratum is gravelly clay loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Woodcock soils increases the seedling mortality rate. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

25. Pinehurst-Greystoke-Bly

Very deep and deep, well drained soils that have a surface layer of loam or are stony loam in the upper part of the surface layer

This map unit is on hillsides and plateaus. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 75 percent. Elevation is 3,000 to 5,200 feet. The mean annual precipitation is about 15 to 30 inches, the mean annual temperature is 42 to 46 degrees F, and the average frost-free period is less than 100 days.

This unit makes up about 4 percent of the survey area. It is about 40 percent Pinehurst soils, 25 percent Greystoke soils, and 10 percent Bly soils. The remaining 25 percent is Kanutchan soils on concave slopes and Booth, Kanutchan Variant, Lorella, Merlin, and Royst soils.

Pinehurst soils formed in colluvium derived from igneous rock. Greystoke soils formed in colluvium and residuum derived from igneous rock. Bly soils formed in sediment derived from igneous rock and volcanic ash.

Pinehurst soils are very deep. The surface layer is loam. The subsoil is clay loam.

Greystoke soils are deep. The upper part of the surface layer is stony loam, and the lower part is very cobbly loam. The subsoil is very cobbly loam and extremely gravelly clay loam.

Bly soils are very deep. The surface layer is loam. The subsoil is clay loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Greystoke soils increases the seedling mortality rate. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

26. Campfour-Paragon

Very deep and moderately deep, well drained soils that have a surface layer of loam or cobbly loam

This map unit is on plateaus and hillslopes. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 35 percent. Elevation is 3,000 to 4,400 feet. The mean annual precipitation is about 20 to 25 inches, the mean annual temperature is 45 to 51 degrees F, and the average frost-free period is 100 to 130 days.

This unit makes up about 1 percent of the survey area. It is about 35 percent Campfour soils and 30 percent Paragon soils. The remaining 35 percent is Shoat soils on mounds in areas of patterned ground, Randcore soils between the mounds in areas of patterned ground, McMullin soils on ridges and steep hillslopes, and Skookum soils.

Campfour soils are very deep. The surface layer is loam. The subsoil is clay loam and gravelly clay loam.

Paragon soils are moderately deep. The surface layer is cobbly loam. The subsoil is gravelly clay loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are compaction and erosion. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. The large number of rock fragments in the Paragon soils increases the seedling mortality rate. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction.

The main limitations affecting livestock grazing are compaction and erosion.

Detailed Soil Map Units

The map units delineated on the detailed maps at the back of this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit is given under "Use and Management of the Soils."

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying layers, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, acidity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Carney clay, 1 to 5 percent slopes, is a phase of the Carney series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or

miscellaneous areas are somewhat similar in all areas. Agate-Winlo complex, 0 to 5 percent slopes, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Riverwash is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The "Glossary" defines many of the terms used in describing the soils or miscellaneous areas.

Map Unit Descriptions

1B—Abegg gravelly loam, 2 to 7 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 2,500 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is very dark grayish brown gravelly loam about 5 inches thick. The next layer is very dark grayish brown and brown very gravelly loam about 17 inches thick. The upper 16 inches of the subsoil is dark yellowish brown extremely gravelly loam. The lower 28 inches is brown and yellowish brown extremely gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Xerorthents; Ruch and Vannoy soils; Camas, Evans, and Newberg soils on flood plains; and Takilma soils on terraces. Also included are small areas of soils that are similar to the Abegg soil but have bedrock at a depth of 40 to 60 inches, poorly drained soils near drainageways, and Abegg soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Abegg soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for hay and pasture. It also is used for timber production and homesite development.

This unit is suited to hay and pasture. It is limited mainly by droughtiness and a large number of rock fragments on and below the surface. The rock fragments limit the use of equipment and increase maintenance costs.

In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Proper stocking rates, pasture rotation, and deferment of grazing during wet periods help to keep pastures in good condition, minimize compaction, and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitation affecting homesite development is the large number of rock fragments on and below the surface. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites.

Establishing plants is difficult in areas where the surface layer has been removed and the extremely gravelly subsoil exposed. Mulching and applying fertilizer help to establish plants in cut areas. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Pine-Douglas Fir-Fescue.

1C—Abegg gravelly loam, 7 to 12 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 2,500 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is very dark grayish brown gravelly loam about 5 inches thick. The next layer is very dark grayish brown and brown very gravelly loam about 17 inches thick. The upper 16 inches of the subsoil is dark yellowish brown extremely gravelly loam. The lower 28 inches is brown and yellowish brown extremely gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Xerorthents; Ruch and Vannoy soils; Camas, Evans, and Newberg soils on flood plains; and Takilma soils on terraces. Also included are small areas of soils that are similar to the Abegg soil but have bedrock at a depth of 40 to 60 inches, poorly drained soils near drainageways, and Abegg soils that have slopes of less than 7 or more than 12 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Abegg soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for hay and pasture. It also is used for timber production and homesite development.

This unit is suited to hay and pasture. It is limited mainly by the slope, droughtiness, and the large number of rock fragments on and below the surface. The rock fragments limit the use of equipment and increase maintenance costs.

In summer, irrigation is needed for the maximum production of most forage crops. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent.

Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the large number of rock fragments on and below the surface and the slope. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls. Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites.

Establishing plants is difficult in areas where the surface layer has been removed and the extremely gravelly subsoil exposed. Mulching and applying fertilizer help to establish plants in cut areas. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Pine-Douglas Fir-Fescue.

2A—Abin silty clay loam, 0 to 3 percent slopes. This very deep, moderately well drained soil is on flood plains. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 2,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown silty clay loam about 34 inches thick. The upper 10 inches of the substratum is very dark brown silty clay loam. The lower part to a depth of 65 inches is very dark grayish brown silty clay loam.

Included in this unit are small areas of Evans, Newberg, and Camas soils; Central Point, Gregory, and Medford soils on terraces; and Cove soils on concave slopes. Also included are small areas of Abin soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Abin soil. Available water capacity is about 11 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The water table fluctuates between depths of 3 and 5 feet from December through April. This soil is occasionally flooded for brief periods from December through April.

This unit is used mainly for irrigated crops, such as

alfalfa hay and small grain. Other crops include corn for silage and tree fruit. Some areas are used for grass-legume hay, pasture, or homesite development.

This unit is suited to irrigated crops. It is limited mainly by the hazard of flooding, the moderately slow permeability, and wetness in winter and spring. The risk of flooding can be reduced by levees, dikes, and diversions.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

A subsurface drainage system can lower the water table if a suitable outlet is available. Land smoothing and open ditches can reduce surface wetness.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet and by planting a cover crop. A permanent cover crop helps to control runoff and erosion.

Maintaining a protective plant cover in winter reduces the soil loss resulting from flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the flooding, the moderately slow permeability, the wetness, the shrink-swell potential, and low strength.

The wetness, the moderately slow permeability, and the hazard of flooding increase the possibility that septic tank absorption fields will fail. The moderately slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields. Dikes and channels that have outlets for floodwater can protect buildings and onsite sewage disposal systems from flooding. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

A drainage system is needed if roads or building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

Roads and streets should be constructed above the expected level of flooding. The risk of flooding has been reduced in some areas by the construction of large dams and reservoirs upstream.

The vegetative site is Loamy Flood Plain, 18- to 30-inch precipitation zone.

3E—Acker-Dumont complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 2,400 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Acker soil and 30 percent Dumont soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Gravecreek, Norling, and Pearsoll soils; Abegg soils on alluvial fans and near drainageways; Atring and Kanid soils on the more sloping parts of the landscape and on convex slopes; and poorly drained soils near drainageways. Also included are small areas of Acker and Dumont soils that have slopes of less than 12 or

more than 35 percent. Included areas make up about 25 percent of the total acreage.

The Acker soil is very deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 4 inches thick. The surface layer is brown gravelly loam about 8 inches thick. The next layer is yellowish brown gravelly clay loam about 9 inches thick. The upper 11 inches of the subsoil is yellowish red gravelly clay loam. The lower 32 inches is strong brown gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Acker soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Dumont soil is very deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly clay loam about 4 inches thick. The next layer is dark reddish brown clay loam about 11 inches thick. The upper 36 inches of the subsoil is yellowish red clay. The lower 9 inches is yellowish red clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, western hemlock, and Pacific madrone. The understory vegetation includes golden chinkapin, salal, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135 on both the Acker and Dumont soils. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are erosion, compaction, and plant competition on both soils and the hazard of slumping on the Dumont soil. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

The Dumont soil is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Mixed Fir-Salal (rhododendron) Forest.

4E—Acker-Dumont complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 2,400 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 40 percent Acker soil and 30 percent Dumont soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Gravecreek, Norling, and Pearsoll soils; Abegg soils on alluvial fans and near drainageways; Atring and Kanid soils on the more sloping parts of the landscape and on convex slopes; and poorly drained soils near drainageways. Also included are small areas of Acker and Dumont soils that have slopes of less than 12 or

more than 35 percent. Included areas make up about 30 percent of the total acreage.

The Acker soil is very deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 4 inches thick. The surface layer is brown gravelly loam about 8 inches thick. The next layer is yellowish brown gravelly clay loam about 9 inches thick. The upper 11 inches of the subsoil is yellowish red gravelly clay loam. The lower 32 inches is strong brown gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Acker soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Dumont soil is very deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly clay loam about 4 inches thick. The next layer is dark reddish brown clay loam about 11 inches thick. The upper 36 inches of the subsoil is yellowish red clay. The lower 9 inches is yellowish red clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes golden chinkapin, Whipplevine, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on both the Acker and Dumont soils. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition on both soils and slumping on the Dumont soil. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Because the Dumont soil is subject to slumping, road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Madrone-Chinkapin Forest.

5F—Acker-Norling complex, 35 to 55 percent north slopes. This map unit is on hillslopes. Elevation is 2,400 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Acker soil and 35 percent Norling soil. The components of this unit occur as areas so intricately intermingled that mapping them

separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Gravecreek, and Pearsoll soils; Dumont soils on the less sloping parts of the landscape and on concave slopes; and Atring and Kanid soils on the more sloping parts of the landscape and on convex slopes. Also included are small areas of Acker and Norling soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 15 percent of the total acreage.

The Acker soil is very deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 4 inches thick. The surface layer is brown gravelly loam about 8 inches thick. The next layer is yellowish brown gravelly clay loam about 9 inches thick. The upper 11 inches of the subsoil is yellowish red gravelly clay loam. The lower 32 inches is strong brown gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Acker soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Norling soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is brown very gravelly loam about 5 inches thick. The next layer is brown gravelly clay loam about 5 inches thick. The upper 12 inches of the subsoil is yellowish brown gravelly clay loam. The lower 7 inches is yellowish brown very cobbly clay loam. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Norling soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, golden chinkapin, and western hemlock. The understory vegetation includes salal, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135 on the Acker soil. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Norling soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are the slope, erosion, compaction, and plant competition. Also, root growth is restricted by the bedrock underlying the Norling soil. As a result, trees are subject to windthrow.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Mixed Fir-Salal (rhododendron) Forest.

6B—Agate-Winlo complex, 0 to 5 percent slopes. This map unit is on fan terraces. Elevation is 1,100 to 1,850 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 55 percent Agate soil and 35 percent Winlo soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used. The soils occur as patterned land. Areas of the Winlo soil are between and around areas of the Agate soil, which is on circular mounds.

Included in this unit are small areas of Cove and Padigan soils on concave slopes and near drainageways; Provig soils, which have slopes of more than 3 percent; Brader and Debenger soils on slightly raised knolls; and, West of Phoenix, small areas of soils that are similar to the Agate soil but are underlain by weakly cemented gravel and do not occur in a patterned land complex. Also included are small areas of Agate and Winlo soils that have slopes of more than 5 percent. Included areas make up about 10 percent of the total acreage.

The Agate soil is moderately deep to a hardpan and is well drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is dark brown loam about 6 inches thick. The next layer is dark yellowish brown clay loam about 6 inches thick. The upper 13 inches of the subsoil is dark brown clay loam. The lower 5 inches is a hardpan. The substratum to a depth of 62 inches is light olive brown extremely gravelly coarse sandy loam. Depth to the hardpan is 20 to 30 inches. The depth to bedrock is 60 inches or more. In some areas the surface layer is gravelly or cobbly.

Permeability is moderately slow in the Agate soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 30 inches. Runoff is slow, and the hazard of water erosion is slight.

The Winlo soil is shallow to a hardpan and is somewhat poorly drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is very dark grayish brown very gravelly clay loam about 4 inches thick. The upper 5 inches of the subsoil is dark brown very gravelly clay. The lower 8 inches is a hardpan. The substratum to a depth of 60 inches is light olive brown extremely gravelly coarse sandy loam. Depth to the hardpan is 7 to 15 inches. The depth to bedrock is 60 inches or more. In some areas the surface layer is very cobbly or very gravelly clay.

Permeability is slow in the Winlo soil. Available water capacity is about 1 inch. The effective rooting depth is 7 to 15 inches. Runoff is ponded, and the hazard of water erosion is slight. The water table fluctuates between 0.5 foot above and 0.5 foot below the surface from December through April.

This unit is used for hay and pasture, homesite development, and livestock grazing.

The main limitations in the areas used for hay and pasture are wetness in winter and spring, droughtiness in summer and fall, depth to the hardpan, compaction, and the very gravelly surface layer of the Winlo soil. In some areas ripping and shattering the hardpan increase the effective rooting depth and improve drainage.

If the pasture or range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. The wetness of the Winlo soil limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. The use of ground equipment is limited by the gravel and cobbles on the surface of the Winlo soil. Proper stocking rates, pasture rotation, and deferred grazing during wet periods help to keep the pasture or range in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

The native vegetation suitable for grazing includes bluebunch wheatgrass, Lemmon needlegrass, and Idaho fescue on the Agate soil and timothy and other wet-meadow grasses on the Winlo soil. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitations are wetness in winter and spring, droughtiness in summer and fall, and depth to the hardpan in the Winlo soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable. To prevent overirrigation and the development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. For the efficient application and removal of surface irrigation water, leveling is needed on the more sloping parts of the landscape. Deep cuts, however, can

expose the hardpan. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the wetness and very gravelly surface layer in the Winlo soil and depth to the hardpan in both soils.

These soils are poorly suited to standard systems of waste disposal because of depth to the hardpan in both soils and the wetness in the Winlo soil. The suitability of the soils for septic tank absorption fields can be improved by ripping the hardpan, which improves permeability and drainage. Alternative waste disposal systems may function properly on these soils. Suitable included soils are in some areas of this unit. Onsite investigation is needed to locate such soils.

Because of the seasonal high water table perched above the hardpan in the Winlo soil, a drainage system is needed on sites for buildings with basements and crawl spaces. It also is needed if roads or building foundations are constructed. Excess water can be removed by suitably designed drainage ditches.

Establishing plants is difficult in areas where the surface layer has been removed and the hardpan exposed. Mulching and applying fertilizer help to establish plants in cut areas. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site in areas of the Agate soil is Biscuit-Scabland (mound), 18- to 26-inch precipitation zone, and the one in areas of the Winlo soil is Poorly Drained Bottom.

7C—Aspenlake-Whiteface complex, 1 to 12 percent slopes. This map unit is on alluvial fans. Elevation is 4,000 to 4,500 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Aspenlake soil and 30 percent Whiteface soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Hoxie, Pokegema, and Woodcock soils; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Aspenlake soil but have a hardpan at a depth of more than 40 inches. Also included are small areas of soils that are similar to the Whiteface soil but have a hardpan within a depth of 10 inches and Aspenlake and Whiteface soils that have slopes of more than 12 percent. Included areas make up about 25 percent of the total acreage.

The Aspenlake soil is moderately deep to a hardpan and is well drained. It formed in alluvium derived dominantly from andesite. Typically, the surface layer is dark brown stony loam about 4 inches thick. The next layer is dark brown gravelly loam about 6 inches thick. The upper 16 inches of the subsoil also is dark brown gravelly loam. The lower 7 inches is a hardpan. Depth to the hardpan is 20 to 40 inches.

Permeability is moderate in the Aspenlake soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

The Whiteface soil is shallow to a hardpan and is well drained. It formed in alluvium derived dominantly from andesite. Typically, the surface layer is dark brown cobbly loam about 8 inches thick. The next layer is dark brown gravelly loam about 4 inches thick. The upper 4 inches of the subsoil is dark brown gravelly clay loam. The lower 7 inches is a hardpan. Depth to the hardpan is 10 to 20 inches.

Permeability is moderate in the Whiteface soil. Available water capacity is about 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of ponderosa pine. The plant community on the Aspenlake soil includes ponderosa pine, Douglas fir, and white fir. The understory vegetation is mainly Douglas spirea, common snowberry, and Idaho fescue. The plant community on the Whiteface soil includes ponderosa pine and a few other conifers. The understory vegetation is mainly birchleaf mountainmahogany, squawcarpet, and Ross sedge.

On the basis of a 100-year site curve, the mean site index for ponderosa pine on the Aspenlake soil is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for ponderosa pine on the Whiteface soil is 75. The yield at culmination of the mean annual increment is 3,100 cubic feet per acre in a fully stocked, even-aged stand of trees at 50 years and 31,680 board feet

per acre (Scribner rule) at 160 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Also, the hardpan in the Whiteface soil restricts root growth. As a result, trees are subject to windthrow.

Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface or the hardpan in the Whiteface soil may be exposed. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting ponderosa pine seedlings.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in both soils and the shallowness of the Whiteface soil also increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and droughtiness. The Whiteface soil also is limited by depth to the hardpan. The native vegetation suitable for grazing includes Idaho fescue, sedge, western fescue, and Wheeler bluegrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the hazard of erosion.

The vegetative site in areas of the Aspenlake soil is Wet Loamy Terrace, and the one in areas of the Whiteface soil is Ponderosa Pine-Fescue.

8A—Barhiskey gravelly loamy sand, 0 to 3 percent slopes. This very deep, excessively drained soil is on outwash plains. It formed in sandy alluvium mixed with pumice and volcanic ash. Elevation is 2,500 to 3,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is black gravelly loamy sand about 4 inches thick. The next layer is dark brown gravelly sand about 15 inches thick. The substratum to a depth of 60 inches is very dark gray gravelly sand. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly.

Included in this unit are small areas of Alcot, Barhiskey Variant, and Crater Lake soils and soils that are similar to the Barhiskey soil but have more than 35 percent rock fragments. Also included are small areas of Barhiskey soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is rapid in the Barhiskey soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir

and ponderosa pine. Other species that grow on this unit include sugar pine and white fir. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 110. The yield at culmination of the mean annual increment is 4,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,820 board feet per acre (Scribner rule) at 110 years.

The main limitations affecting timber production are seedling mortality and the sandy surface layer. The sandy surface layer hinders the use of wheeled and tracked logging equipment, especially when the soil is saturated or very dry. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction generally is not a problem on this unit. In areas where it is a concern, it can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. When dry, unsurfaced roads and skid trails are dusty. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings (fig. 5).

The main limitations affecting livestock grazing are droughtiness and soil displacement. The native vegetation suitable for grazing includes western fescue, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Displacement of the surface layer occurs most readily when the soil is dry.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. Success may be limited, however, because of droughtiness and soil displacement.

The vegetative site is Mixed Fir-Mixed Pine Forest.

9A—Barhiskey Variant gravelly loamy sand, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on outwash plains. It formed in alluvium mixed with pumice and volcanic ash. Elevation is 2,500 to 2,700 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is black gravelly loamy sand about 8 inches thick. The next layer is very dark grayish brown gravelly sand about 21 inches thick. The substratum to a depth of 60 inches is very dark gray gravelly sand. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Alcot, Barhiskey, and Crater Lake soils; soils that are similar to the Barhiskey Variant soil but have more than 35 percent rock fragments; and very poorly drained, organic soils in depressions and near drainageways. Also included are small areas of Barhiskey Variant soils that have slopes of more than 3 percent. Included areas make up about 10 percent of the total acreage.

Permeability is rapid in the Barhiskey Variant soil. Available water capacity is about 4 inches. The effective rooting depth is limited by the water table, which is at a depth of 1 to 3 feet from January through August. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for hay and pasture and for wildlife habitat. It is well suited to hay and pasture. The main limitations are wetness in winter and spring and droughtiness in summer and fall. Tile drainage can

Figure 5.—Ponderosa pine seedlings on Barhiskey gravelly loamy sand, 0 to 3 percent slopes.

lower the water table if a suitable outlet is available. Land smoothing and open ditches can reduce surface wetness.

In summer, irrigation is needed for the maximum production of most forage crops. Because the rate of water intake is rapid, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of

grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is limited as a site for livestock watering ponds and other water impoundments because of seepage.

The vegetative site is Mixed Fir-Mixed Pine Forest, Wet.

10B—Barron coarse sandy loam, 0 to 7 percent slopes. This very deep, somewhat excessively drained soil is on alluvial fans. It formed in alluvium derived dominantly from granitic rock. Elevation is 1,000 to 2,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown coarse sandy loam about 6 inches thick. The subsoil is brown sandy loam about 17 inches thick. The upper 14 inches of the substratum is dark yellowish brown sandy loam. The lower part to a depth of 60 inches is brown sandy loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Clawson and Kubli soils near drainageways and on concave slopes, Central Point soils on the lower parts of the landscape, and Ruch and Shefflein soils. Also included are small areas of Barron soils that have slopes of more than 7 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Barron soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated crops, such as alfalfa hay, small grain, tree fruit, and grass-legume hay. It also is used for timber production, pasture, and homesite development.

This unit is well suited to irrigated crops. It is limited mainly by droughtiness. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, leveling is needed on the more sloping parts of the landscape. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction and displacement can be minimized by limiting the use of equipment when the soil is too wet or too dry. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. It has few limitations. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 110. The yield at culmination of the mean annual increment is 4,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,820 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

10C—Barron coarse sandy loam, 7 to 12 percent slopes. This very deep, somewhat excessively drained soil is on alluvial fans. It formed in alluvium derived dominantly from granitic rock. Elevation is 1,000 to 2,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown coarse sandy loam about 6 inches thick. The subsoil is brown sandy loam about 17 inches thick. The upper 14 inches of the substratum is dark yellowish brown sandy loam. The lower part to a depth of 60 inches is brown sandy loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Clawson and Kubli soils near drainageways and on concave slopes, Central Point soils on the lower parts of the landscape, and Ruch and Shefflein soils. Also included are small areas of Barron soils that have slopes of less than 7 or more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Barron soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate.

This unit is used mainly for irrigated crops, such as alfalfa hay, small grain, tree fruit, and grass-legume hay. It also is used for timber production, pasture, and homesite development.

This unit is well suited to irrigated crops. It is limited mainly by the slope, the hazard of erosion, and droughtiness. In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction and displacement can be minimized by limiting the use of equipment when the soil is too wet or too dry. A permanent cover crop helps to control runoff and erosion.

Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help

to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. The main limitation is the slope. Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 110. The yield at culmination of the mean annual increment is 4,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,820 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

11G—Beekman-Colestine gravelly loams, 50 to 80 percent north slopes. This map unit is on hillslopes. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Beekman soil and 30 percent Colestine soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Goolaway, Musty, Pearsoll, Siskiyou, Speaker, and Tethrick soils; Josephine soils on concave slopes; and McMullin soils and Rock outcrop on ridges and convex slopes. Also included are small areas of Beekman and Colestine soils that have slopes of less than 50 or more than 80 percent. Included areas make up about 15 percent of the total acreage.

The Beekman soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface layer is dark brown gravelly loam about 14 inches thick. The subsoil is grayish brown extremely gravelly loam about 14 inches thick. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Beekman soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and

the hazard of water erosion is high.

The Colestine soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown and dark brown gravelly loam about 9 inches thick. The subsoil is brown gravelly clay loam about 25 inches thick. Bedrock is at a depth of about 34 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Colestine soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and sugar pine. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Beekman soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Colestine soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soils also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

12G—Beekman-Colestine gravelly loams, 50 to 75 percent south slopes. This map unit is on hillslopes. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Beekman soil and 25 percent Colestine soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Goolaway, Musty, Pearsoll, Siskiyou, Speaker, and Tethrick soils; Josephine soils on concave slopes; and McMullin soils and Rock outcrop on ridges and convex slopes. Also included are small areas of Beekman and Colestine soils that have slopes of less than 50 or more than 75 percent. Included areas make up about 20 percent of the total acreage.

The Beekman soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface layer is dark brown gravelly loam about 14 inches thick. The subsoil is grayish brown extremely gravelly loam about 14 inches thick. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Beekman soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Colestine soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown and dark brown gravelly loam about 9 inches thick. The subsoil is brown gravelly clay loam about 25 inches thick. Bedrock is at a depth of about 34 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Colestine soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on the unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Beekman soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115 on the Colestine soil. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are the slope, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soils also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings (fig. 6).

Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Black Oak Forest.

13C—Bly-Royst complex, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 3,800 to 4,300 feet. The mean annual precipitation is 15 to 25 inches, the mean annual temperature is 43 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers

Figure 6.—Shade cards used to protect planted seedlings in a clearcut area of Beekman-Colestine gravelly loams, 50 to 75 percent south slopes.

and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Bly soil and 25 percent Royst soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Greystoke, Merlin, and Kanutchan Variant soils, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Bly soil but have bedrock within a depth of 60 inches. Also included are small areas of Bly and Royst soils that have slopes of more than 12 percent. Included areas make up about 20 percent of the total acreage.

The Bly soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is very dark brown loam about 17 inches thick. The upper 19 inches of the subsoil is dark brown clay loam. The lower 24 inches is

dark yellowish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is very gravelly or very cobbly.

Permeability is moderately slow in the Bly soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Royst soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 10 inches thick. Weathered bedrock is at a depth of about 21 inches. It becomes harder as depth increases. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly or very cobbly.

Permeability is slow in the Royst soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of ponderosa pine. Other species that grow on this unit include an occasional Douglas fir and white fir. The understory vegetation includes antelope bitterbrush, common snowberry, and sedge.

On the basis of a 100-year site curve, the mean site index for ponderosa pine on the Bly soil is 100. The yield at culmination of the mean annual increment is 4,080 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 44,640 board feet per acre (Scribner rule) at 120 years.

On the basis of a 100-year site curve, the mean site index for ponderosa pine on the Royst soil is 80. The yield at culmination of the mean annual increment is 3,060 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 33,750 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production are compaction, erosion, and seedling mortality. Also, the bedrock underlying the Royst soil restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting ponderosa pine seedlings.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Royst soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes sedge, Idaho fescue, and Wheeler bluegrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Ponderosa Pine-Fescue.

13E—Bly-Royst complex, 12 to 35 percent slopes. This map unit is on hillslopes. Elevation is 3,800 to 4,300 feet. The mean annual precipitation is 15 to 25 inches, the mean annual temperature is 43 to 45

degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Bly soil and 25 percent Royst soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Greystoke and Merlin soils, poorly drained soils on concave slopes near drainageways, and soils that are similar to the Bly soil but have bedrock within a depth of 60 inches. Also included are small areas of Bly and Royst soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Bly soil is very deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is very dark brown loam about 17 inches thick. The upper 19 inches of the subsoil is dark brown clay loam. The lower 24 inches is dark yellowish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is very gravelly, very cobbly, or stony.

Permeability is moderately slow in the Bly soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Royst soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 10 inches thick. Weathered bedrock is at a depth of about 21 inches. It becomes harder as depth increases. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly, very cobbly, or stony.

Permeability is slow in the Royst soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of ponderosa pine. Other species that grow on this unit include an occasional Douglas fir and white fir. The understory vegetation includes antelope bitterbrush, common snowberry, and sedge.

On the basis of a 100-year site curve, the mean site index for ponderosa pine on the Bly soil is 100. The yield at culmination of the mean annual increment is 4,080 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 44,640 board feet per acre (Scribner rule) at 120 years.

On the basis of a 100-year site curve, the mean site index for ponderosa pine on the Royst soil is 80. The yield at culmination of the mean annual increment is 3,060 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 33,750 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production are erosion, compaction, and seedling mortality. Also, the bedrock underlying the Royst soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Royst soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes sedge, Idaho fescue, and Wheeler bluegrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Ponderosa Pine-Fescue.

14G—Bogus very gravelly loam, 35 to 65 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,000 to 4,000 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 45 to 51 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is black very gravelly loam about 7 inches thick. The next layer is very dark grayish brown very gravelly loam about 8 inches thick. The upper 6 inches of the subsoil is dark brown gravelly clay loam. The lower 44 inches is dark yellowish brown and dark brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes, Heppsie soils, and soils that are similar to the Bogus soil but have bedrock within a depth of 60 inches or have more than 35 percent rock fragments. Also included are small areas of Bogus soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Bogus soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and California black oak. The understory vegetation includes tall Oregon grape, common snowberry, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require

suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The native vegetation suitable for grazing includes western fescue, tall trisetum, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir-Mixed Pine-Sedge Forest.

15C—Bogus-Skookum complex, 1 to 12 percent slopes. This map unit is on old terraces along the Klamath River. Elevation is 3,000 to 4,400 feet. The mean annual precipitation is 18 to 25 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation on the Bogus soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. That on the Skookum soil is mainly grasses, shrubs, and forbs but includes scattered hardwoods.

This unit is about 50 percent Bogus soil and 30 percent Skookum soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Heppsie soils, Lorella soils and Rock outcrop on convex slopes, Carney soils on concave slopes, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of soils that are similar to the Bogus soil but have bedrock within a depth of 60 inches, soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches, and Bogus and Skookum soils that have slopes of more than 12 percent. Included areas make up about 20 percent of the total acreage.

The Bogus soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is black very gravelly loam about 7 inches thick. The next layer is very dark grayish brown very gravelly loam about 8 inches thick. The upper 6 inches of the subsoil is dark brown gravelly clay loam. The lower 44 inches is dark yellowish brown and dark brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is loam or is stony.

Permeability is slow in the Bogus soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Skookum soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for livestock grazing or wildlife habitat. The Bogus soil also is used for timber production. A few areas have been cleared and are used for pasture.

The main limitation affecting livestock grazing is compaction. The Skookum soil also is limited by cobbles and stones on the surface and by droughtiness. The vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum on the Bogus soil and Idaho fescue, bluebunch wheatgrass, and pine

bluegrass on the Skookum soil. If the range or understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment is limited by the cobbles and stones on the surface of the Skookum soil.

Range seeding is suitable if the site is in poor condition. The main limitations are the very cobbly surface layer and droughtiness of the Skookum soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock in the Skookum soil.

The Bogus soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and California black oak. The understory vegetation includes tall Oregon grape, common snowberry, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Bogus soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90 on the Bogus soil. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production on the Bogus soil are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in some areas also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site in areas of the Bogus soil is Douglas Fir-Mixed Pine-Sedge Forest, and the one in areas of the Skookum soil is Droughty Slopes, 20- to 30-inch precipitation zone.

16A—Booth-Kanutchan Variant complex, 0 to 3 percent slopes. This map unit is on plateaus. Elevation is 4,000 to 4,500 feet. The mean annual precipitation is about 18 inches, the mean annual temperature is 43 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 40 percent Booth soil and 35 percent Kanutchan Variant soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Greystoke, Kanutchan, Merlin, Pinehurst, and Royst soils. Also included are small areas of Booth and Kanutchan Variant soils that have slopes of more than 3 percent. Included areas make up about 25 percent of the total acreage.

The Booth soil is moderately deep and well drained. It formed in colluvium derived dominantly from tuff. Typically, the surface layer is dark brown loam about 15

inches thick. The upper 11 inches of the subsoil is brown clay. The lower 9 inches is dark yellowish brown clay. Weathered bedrock is at a depth of about 35 inches. It becomes harder as depth increases. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the Booth soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

The Kanutchan Variant soil is moderately deep and moderately well drained. It is in depressions. It formed in alluvium derived dominantly from tuff and andesite. Typically, the surface layer is dark brown clay about 3 inches thick. The subsoil is dark reddish brown clay about 18 inches thick. Bedrock is at a depth of about 21 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is very slow in the Kanutchan Variant soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is ponded, and the hazard of water erosion is slight. The water table is 0.5 foot above the surface from February through May.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction and droughtiness in summer and fall. The Kanutchan Variant soil also is limited by the clayey surface layer and wetness in winter and spring. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and Sandberg bluegrass on the Booth soil and Nevada bluegrass and slender wheatgrass on the Kanutchan Variant soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants on both soils have achieved enough growth to withstand grazing pressure and until the Kanutchan Variant soil is firm enough to withstand trampling by livestock. The Kanutchan Variant soil generally is drained later in the year than the Booth soil.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer and wetness in winter and spring in the Kanutchan Variant soil and the droughtiness of both soils in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The vegetative site in areas of the Booth soil is Claypan, 14- to 18-inch precipitation zone, and the one in areas of the Kanutchan Variant soil is Intermittent Swale.

17C—Brader-Debenger loams, 1 to 15 percent slopes. This map unit is on knolls and ridges. Elevation is 1,000 to 3,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Brader soil and 20 percent Debenger soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop on ridges and convex slopes; Carney, Coker, and Darow soils on concave slopes; Padigan soils near drainageways; Langellain and Ruch soils; and soils that are similar to the Brader soil but have bedrock within a depth of 12 inches. Also included are small areas of Brader and Debenger soils that have slopes of more than 15 percent. Included areas make up about 20 percent of the total acreage.

The Brader soil is shallow and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil is dark reddish brown loam about 7 inches thick. Weathered bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the Brader soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

The Debenger soil is moderately deep and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 5 inches thick. The next layer is reddish brown loam about 4 inches thick. The subsoil is reddish brown and yellowish red clay loam about 18 inches thick. Weathered bedrock is at a depth of about 27 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Debenger soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used for livestock grazing, hay and pasture, and homesite development.

The main limitations affecting livestock grazing are compaction, erosion, droughtiness, and the depth to

bedrock in the Brader soil. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Range seeding is suitable if the site is in poor condition. The main limitations are droughtiness and the depth to bedrock in the Brader soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The main limitations affecting the use of this unit for hay and pasture are the depth to bedrock in the Brader soil and droughtiness in both soils. In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable in the less sloping areas. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the depth to bedrock in the Brader soil, however, leveling may expose bedrock. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitation affecting homesite development is the depth to bedrock. Cuts needed to provide essentially level building sites can expose bedrock.

This unit is poorly suited to septic tank absorption fields because of the depth to bedrock. The absorption fields can be installed in some areas of included soils that have bedrock at a greater depth. Onsite investigation is needed to locate such areas.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site in areas of the Brader soil is Loamy Hills, 20- to 35-inch precipitation zone, and the one in areas of the Debenger soil is Loamy Slopes, 18- to 24-inch precipitation zone.

17E—Brader-Debenger loams, 15 to 40 percent slopes. This map unit is on knolls and ridges (fig. 7). Elevation is 1,000 to 3,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Brader soil and 20 percent Debenger soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop on ridges and convex slopes, Carney and Darow soils on concave slopes, Padigan soils near drainageways, Heppsie soils on the steeper parts of the landscape, and Langellain and Ruch soils. Also included are small areas of soils that are similar to the Debenger and Brader soils but have more than 35 percent rock fragments, soils that are similar to the Brader soil but have bedrock within a depth of 12 inches, and Brader and Debenger soils that have slopes of less than 15 or more than 40 percent. Included areas make up about 25 percent of the total acreage.

The Brader soil is shallow and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil is dark reddish brown loam about 7 inches thick. Weathered bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the Brader soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

The Debenger soil is moderately deep and well drained. It formed in colluvium derived dominantly from

Figure 7.—An area of Brader-Debenger loams, 15 to 40 percent slopes, on a knoll. Abin silty clay loam, 0 to 3 percent slopes, is on the flood plain in the foreground.

sandstone. Typically, the surface layer is dark brown loam about 5 inches thick. The next layer is reddish brown loam about 4 inches thick. The subsoil is reddish brown and yellowish red clay loam about 18 inches thick. Weathered bedrock is at a depth of about 27 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Debenger soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used mainly for livestock grazing or homesite development. Some of the less sloping areas are used for hay and pasture.

The main limitations affecting livestock grazing are compaction, erosion, droughtiness, the depth to bedrock in the Brader soil, and the slope. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Range seeding is suitable if the site is in poor condition. The main limitations are droughtiness, the depth to bedrock in the Brader soil, and the slope. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing,

and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment and access by livestock are limited on some of the steeper parts of the landscape. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The main limitations affecting homesite development are the depth to bedrock and the slope.

This unit is poorly suited to septic tank absorption fields because of the depth to bedrock and the slope. The absorption fields can be installed in some areas of the unit where the soils are deeper over bedrock and are less sloping. Onsite investigation is needed to locate such areas.

The slope limits the use of the steeper parts of this unit for building site development. Cuts needed to provide essentially level building sites can expose bedrock. Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site in areas of the Brader soil is Loamy Hills, 20- to 35-inch precipitation zone, and the one in areas of the Debenger soil is Loamy Slopes, 18- to 24-inch precipitation zone.

18C—Bybee loam, 1 to 12 percent slopes. This very deep, somewhat poorly drained soil is on plateaus. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is very dark grayish brown loam about 4 inches thick. The next layer is very dark grayish brown clay loam about 6 inches thick. The upper 4 inches of the subsoil is brown clay. The lower 24 inches is light yellowish brown clay. The substratum is light yellowish brown clay about 22 inches thick. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Pinehurst and Tatouche soils, Kanutchan and Sibannac soils on concave slopes, and Farva soils on convex slopes. Also included are small areas of Bybee soils that have slopes of more than 12 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Bybee soil. Available water capacity is about 9 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 10 to 20 inches. Runoff is slow, and the hazard of water erosion is slight. The water table, which is perched above the layer of clay, is at a depth of 1 to 3 feet from December through May.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are compaction, erosion, slumping, seasonal wetness, seedling mortality, and plant competition. Also, the dense layer of clay restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or to midwinter, when the soil is frozen. The soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

This unit is subject to severe slumping, especially in areas of road cuts. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine. The seasonal wetness increases the seedling mortality rate. Also, seedlings planted in the less fertile clayey subsoil grow poorly.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and the seasonal wetness. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Because this unit remains wet for long periods in spring, grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

19E—Bybee-Tatouche complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Bybee soil and 30 percent Tatouche soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Pinehurst soils, Kanutchan and Sibannac soils on concave slopes, Farva and Woodseye soils on convex slopes, and soils that are similar to the Tatouche soil but have bedrock within a depth of 60 inches. Also included are small areas of Bybee and Tatouche soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Bybee soil is very deep and somewhat poorly drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is very dark grayish brown loam about 4 inches thick. The next layer is very dark grayish brown clay loam about 6 inches thick. The upper 4 inches of the subsoil is brown clay. The lower 24 inches is light yellowish brown clay. The substratum is light yellowish brown clay about 22 inches thick. The depth to bedrock is 60 inches or more.

Permeability is very slow in the Bybee soil. Available water capacity is about 9 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table, which is perched above the layer of clay, is at a depth of 1 to 3 feet from December through May.

The Tatouche soil is very deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is very dark brown gravelly loam about 11 inches thick. The upper 8 inches of the subsoil is dark brown gravelly clay loam. The lower 41 inches is dark brown clay. The substratum to a depth of 73 inches is strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony or cobbly.

Permeability is moderately slow in the Tatouche soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and whitevein shinleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115 on the Bybee soil. The yield at culmination of the mean annual increment is 6,360

cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Tatouche soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. The dense layer of clay in the Bybee soil restricts root growth. As a result, windthrow is a hazard. This soil also is limited by seasonal wetness and slumping.

The seasonal high water table in the Bybee soil restricts the use of equipment to midsummer, when the soil is dry, or to midwinter, when the soil is frozen. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

The Bybee soil is subject to severe slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration. The seasonal wetness in the Bybee soil increases the seedling mortality rate. Also, seedlings planted in the less fertile clayey subsoil grow poorly.

The main limitations affecting livestock grazing are compaction, erosion, and the seasonal wetness of the Bybee soil. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. The Bybee soil remains wet for long periods in spring; therefore, grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Oceanspray Forest.

20E—Bybee-Tatouche complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Bybee soil and 30 percent Tatouche soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Pinehurst soils, Kanutchan and Sibannac soils on concave slopes, Farva and Woodseye soils and Rock outcrop on convex slopes, and soils that are similar to the Tatouche soil but have bedrock within a depth of 60 inches. Also included are small areas of Bybee and Tatouche soils

that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Bybee soil is very deep and somewhat poorly drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is very dark grayish brown loam about 4 inches thick. The next layer is very dark grayish brown clay loam about 6 inches thick. The upper 4 inches of the subsoil is brown clay. The lower 24 inches is light yellowish brown clay. The substratum is light yellowish brown clay about 22 inches thick. The depth to bedrock is 60 inches or more.

Permeability is very slow in the Bybee soil. Available water capacity is about 9 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table, which is perched above the layer of clay, is at a depth of 1 to 3 feet from December through May.

The Tatouche soil is very deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is very dark brown gravelly loam about 11 inches thick. The upper 8 inches of the subsoil is dark brown gravelly clay loam. The lower 41 inches is dark brown clay. The substratum to a depth of 73 inches is strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony or cobbly.

Permeability is moderately slow in the Tatouche soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Bybee soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Tatouche soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. The dense layer of clay in the Bybee soil restricts root growth. As a result, windthrow is a hazard. This soil also is limited by seasonal wetness and slumping.

The seasonal high water table in the Bybee soil restricts the use of equipment to midsummer, when the soil is dry, or to midwinter, when the soil is frozen. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

The Bybee soil is subject to severe slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect

of frost on regeneration. The seasonal wetness in the Bybee soil increases the seedling mortality rate. Also, seedlings planted in the less fertile clayey subsoil grow poorly.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction, erosion, and the seasonal wetness of the Bybee soil. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. The Bybee soil remains wet for long periods in spring; therefore, grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

21A—Camas sandy loam, 0 to 3 percent slopes. This very deep, excessively drained soil is on flood plains. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown sandy loam about 10 inches thick. The upper 9 inches of the substratum is very dark grayish brown very gravelly loamy sand. The lower part to a depth of 60 inches is very dark grayish brown extremely gravelly coarse sand. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Riverwash; Cove soils on concave slopes; Central Point, Medford, and Takilma soils on terraces; Abin, Evans, and Newberg soils; and poorly drained soils. Also included are small areas of Camas soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Camas soil and very rapid in the lower part. Available water capacity is about 3 inches. The effective rooting depth is 60 inches or more. The substratum can restrict the penetration of roots, however, because of droughtiness. Runoff is slow, and the hazard of water erosion is slight. This soil is occasionally flooded for brief periods from November through May.

This unit is used mainly for hay and pasture. It also is used for cultivated crops, such as small grain, and for homesite development.

This unit is suited to hay and pasture. The main limitations are the flooding and droughtiness. The risk of flooding can be reduced by levees, dikes, and diversions.

In summer, irrigation is needed for the maximum production of most forage crops. Because the rate of water intake is rapid, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent.

Maintaining a protective plant cover in winter reduces the soil loss resulting from flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

This unit is poorly suited to homesite development. The main limitations are the flooding and the very rapid permeability in the substratum.

This unit is poorly suited to standard systems of waste disposal because of a poor filtering capacity in the extremely gravelly substratum and the hazard of flooding. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils. Dikes and channels that have outlets for floodwater can protect buildings and onsite sewage disposal systems from flooding.

In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating as soon as possible in disturbed areas around construction sites helps to control soil blowing. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls.

Establishing plants in areas where the surface layer has been removed is difficult. Mulching and applying fertilizer help to establish plants in cut areas. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

Roads and streets should be constructed above the expected level of flooding. The risk of flooding has been reduced in some areas by the construction of large dams and reservoirs upstream.

The vegetative site is Loamy Flood Plain, 18- to 30-inch precipitation zone.

22A—Camas gravelly sandy loam, 0 to 3 percent slopes. This very deep, excessively drained soil is on flood plains. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown gravelly sandy loam about 10 inches thick. The upper 9 inches of the substratum is very dark grayish brown very gravelly loamy sand. The lower part to a depth of 60 inches is very dark grayish brown extremely gravelly coarse sand. In some areas the surface layer is very gravelly or cobbly.

Included in this unit are small areas of Riverwash; Cove soils on concave slopes; Central Point, Medford, and Takilma soils on terraces; Abin, Evans, and Newberg soils; and poorly drained soils. Also included are small areas of Camas soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Camas soil and very rapid in the lower part. Available water capacity is about 3 inches. The effective rooting depth is 60 inches or more. The substratum can restrict the penetration of roots, however, because of droughtiness. Runoff is slow, and the hazard of water erosion is slight. This soil is occasionally flooded for brief periods from November through May.

This unit is used mainly for hay and pasture. It also is used for cultivated crops, such as small grain, and for homesite development.

This unit is suited to hay and pasture. The main limitations are the flooding, droughtiness, and gravel on the surface, which may limit the use of equipment. The risk of flooding can be reduced by levees, dikes, and diversions.

In summer, irrigation is needed for the maximum production of most forage crops. Because the rate of water intake is rapid, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent.

Maintaining a protective plant cover in winter reduces the soil loss resulting from flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

This unit is poorly suited to homesite development. The main limitations are the flooding and the very rapid permeability in the substratum.

This unit is poorly suited to standard systems of waste disposal because of a poor filtering capacity in the extremely gravelly substratum and the hazard of flooding. Alternative waste disposal systems may

function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils. Dikes and channels that have outlets for floodwater can protect buildings and onsite sewage disposal systems from flooding.

In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating as soon as possible in disturbed areas around construction sites helps to control soil blowing. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls.

Establishing plants is difficult in areas where the surface layer has been removed and the extremely gravelly substratum exposed. Mulching and applying fertilizer help to establish plants in cut areas. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

Roads and streets should be constructed above the expected level of flooding. The risk of flooding has been reduced in some areas by the construction of large dams and reservoirs upstream.

The vegetative site is Loamy Flood Plain, 18- to 30-inch precipitation zone.

23A—Camas-Newberg-Evans complex, 0 to 3 percent slopes. This map unit is on flood plains. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 40 percent Camas soil, 30 percent Newberg soil, and 20 percent Evans soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Riverwash; Cove soils on concave slopes; Central Point, Medford, and Takilma soils on terraces; Abin soils; and poorly drained soils. Also included are small areas of Camas, Newberg, and Evans soils that have slopes of more than 3 percent. Included areas make up about 10 percent of the total acreage.

The Camas soil is very deep and excessively drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is dark brown gravelly sandy loam about 10 inches thick. The upper 9 inches of the substratum is very dark grayish brown very gravelly loamy sand. The lower part to a depth of 60 inches is very dark grayish brown extremely gravelly coarse sand. In some areas the surface layer is very gravelly or cobbly.

Permeability is moderately rapid in the upper part of the Camas soil and very rapid in the lower part. Available water capacity is about 3 inches. The effective rooting depth is 60 inches or more. The substratum can restrict the penetration of roots, however, because of droughtiness. Runoff is slow, and the hazard of water erosion is slight. This soil is occasionally flooded for brief periods from November through May. In some areas the water table is within a depth of 60 inches.

The Newberg soil is very deep and somewhat excessively drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is very dark grayish brown fine sandy loam about 17 inches thick. The upper 13 inches of the substratum is dark brown sandy loam. The next 12 inches is dark brown fine sand. The lower part to a depth of 60 inches is dark grayish brown loamy sand. In some areas the surface layer is gravelly or cobbly.

Permeability is moderately rapid in the upper part of the Newberg soil and rapid in the lower part. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. The substratum can restrict the penetration of roots, however, because of droughtiness. Runoff is slow, and the hazard of water erosion is slight. This soil is occasionally flooded for brief periods from December through March. In some areas the water table is within a depth of 60 inches.

The Evans soil is very deep and well drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is very dark brown loam about 38 inches thick. The substratum to a depth of 60 inches is dark brown loam. In some areas the surface layer is gravelly or cobbly.

Permeability is moderate in the Evans soil. Available water capacity is about 11 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. This soil is occasionally flooded for brief periods from December through March. In some areas the water table is within a depth of 60 inches.

This unit is used mainly for wildlife habitat or for hay and pasture. It also is used for homesite development.

The main limitations in the areas used for hay and pasture are the flooding, droughtiness, and gravel on the surface, which may limit the use of equipment. The risk of flooding can be reduced by levees, dikes, and diversions.

In summer, irrigation is needed for the maximum production of most forage crops. Because of a moderately rapid rate of water intake in the Camas and

Newberg soils, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soils are droughty, the applications should be light and frequent.

Maintaining a protective plant cover in winter reduces the soil loss resulting from flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Returning all crop residue to the soils and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

This unit is poorly suited to homesite development. The main limitations are the flooding and the rapid or very rapid permeability in the substratum of the Camas and Newberg soils.

This unit is poorly suited to standard systems of waste disposal because of a poor filtering capacity in the substratum of the Camas and Newberg soils and the hazard of flooding. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils. Dikes and channels that have outlets for floodwater can protect buildings and onsite sewage disposal systems from flooding.

In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating as soon as possible in disturbed areas around construction sites helps to control soil blowing. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls.

Establishing plants is difficult in areas where the surface layer has been removed. Mulching and applying fertilizer help to establish plants in cut areas. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

Roads and streets should be constructed above the expected level of flooding. The risk of flooding has been reduced in some areas by the construction of large dams and reservoirs upstream.

The vegetative site is Loamy Flood Plain, 18- to 30-inch precipitation zone.

24C—Campfour-Paragon complex, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 3,000 to 4,400 feet. The mean annual precipitation is 20 to 25 inches, the mean annual temperature is 45 to 51 degrees F, and the average frost-free period is 100 to 130 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Campfour soil and 30 percent Paragon soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop; Carney, Randcore, Shoat, and Skookum soils; and soils that are similar to the Paragon soil but have more than 35 percent hard rock fragments or have bedrock at a depth of more than 40 inches. Also included are small areas of Campfour and Paragon soils that have slopes of more than 12 percent. Included areas make up about 25 percent of the total acreage.

The Campfour soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 5 inches thick. The next layer is dark reddish brown loam about 16 inches thick. The upper 29 inches of the subsoil is dark reddish brown clay loam. The lower 10 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Campfour soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Paragon soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown cobbly loam about 3 inches thick. The next 10 inches also is dark reddish brown cobbly loam. The subsoil is dark reddish brown gravelly clay loam about 12 inches thick. Weathered bedrock is at a depth of about 25 inches.

The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or very cobbly.

Permeability is moderately slow in the Paragon soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar and California black oak. The understory vegetation includes tall Oregon grape, common snowberry, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Campfour soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 95 on the Campfour soil. The yield at culmination of the mean annual increment is 3,760 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 43,160 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85 on the Paragon soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 80 on the Paragon soil. The yield at culmination of the mean annual increment is 2,670 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 33,750 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production are compaction, erosion, and seedling mortality. Also, the bedrock underlying the Paragon soil restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Paragon soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, tall trisetum, and mountain brome on the Campfour soil and Idaho fescue and bluegrass on the Paragon soil. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site in areas of the Campfour soil is Douglas Fir-Mixed Pine-Sedge Forest, and the one in areas of the Paragon soil is Loamy Slopes, 18- to 24-inch precipitation zone.

24E—Campfour-Paragon complex, 12 to 35 percent slopes. This map unit is on hillslopes. It is commonly on south-facing slopes. Elevation is 3,000 to 4,400 feet. The mean annual precipitation is 20 to 25 inches, the mean annual temperature is 45 to 51 degrees F, and the average frost-free period is 100 to 130 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Campfour soil and 30 percent Paragon soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop; Carney, Randcore, Shoat, and Skookum soils; and soils that are similar to the Paragon soil but have more than 35 percent hard rock fragments or have bedrock at a depth of more than 40 inches. Also included are small areas of Campfour and Paragon soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 25 percent of the total acreage.

The Campfour soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 5 inches thick. The next layer is dark reddish brown loam about 16 inches thick. The upper 29 inches of the subsoil is dark reddish brown clay loam. The lower 10 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Campfour soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Paragon soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown cobbly loam about 3 inches thick. The next 10 inches also is dark reddish brown cobbly loam. The subsoil is dark reddish brown gravelly clay loam about 12 inches thick. Weathered bedrock is at a depth of about 25 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or very cobbly.

Permeability is moderately slow in the Paragon soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar and California black oak. The understory vegetation includes tall Oregon grape, common snowberry, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Campfour soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 95 on the Campfour soil. The yield at culmination of the mean annual increment is 3,760 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 43,160 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85 on the Paragon soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 80 on the Paragon soil. The yield at culmination of the mean annual increment is 2,670 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 33,750 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production are erosion, compaction, and seedling mortality. Also, the bedrock underlying the Paragon soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding

paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Paragon soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Severe frost can damage or kill seedlings in the less sloping areas where air drainage may be restricted. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, tall trisetum, and mountain brome on the Campfour soil and Idaho fescue and bluegrass on the Paragon soil. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site in areas of the Campfour soil is Douglas Fir-Mixed Pine-Sedge Forest, and the one in areas of the Paragon soil is Loamy Slopes, 18- to 24-inch precipitation zone.

25G—Caris-Offenbacher gravelly loams, 50 to 80 percent north slopes. This map unit is on hillslopes. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Caris soil and 30 percent Offenbacher soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Tallowbox, Vannoy, and Voorhies soils; small areas of McMullin soils and Rock outcrop on ridges and convex slopes; and, on concave slopes, soils that are similar to the Caris and Offenbacher soils but have bedrock at a depth of more than 40 inches. Also included are small areas of Caris and Offenbacher soils that have slopes of less than 50 or more than 80 percent. Included areas make up about 10 percent of the total acreage.

The Caris soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 7 inches thick. The upper 13 inches of the subsoil is dark yellowish brown very gravelly clay loam. The lower 11 inches is dark yellowish brown extremely gravelly loam. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Caris soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Offenbacher soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark grayish brown and dark brown gravelly loam about 9 inches thick. The subsoil is reddish brown and yellowish red loam about 25 inches thick. Bedrock is at a depth of about 34 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Offenbacher soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, ponderosa pine, and Pacific madrone. The understory vegetation includes oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site

index for Douglas fir is 105 on the Caris soil. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Offenbacher soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are the slope, erosion, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soils also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir Forest.

26G—Caris-Offenbacher gravelly loams, 50 to 75 percent south slopes. This map unit is on hillslopes. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Caris soil and 20 percent Offenbacher soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Tallowbox, Vannoy, and Voorhies soils; McMullin soils and Rock outcrop on ridges and convex slopes; and, on concave slopes, soils that are similar to the Caris and Offenbacher soils but have bedrock at a depth of more than 40 inches. Also included are small areas of Caris and Offenbacher soils that have slopes of less than 50 percent and more than 75 percent. Included areas make up about 20 percent of the total acreage.

The Caris soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 7 inches thick. The upper 13 inches of the subsoil is dark yellowish brown very gravelly clay loam. The lower 11 inches is dark yellowish brown extremely gravelly loam. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Caris soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Offenbacher soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark grayish brown and dark brown

gravelly loam about 9 inches thick. The subsoil is reddish brown and yellowish red loam about 25 inches thick. Bedrock is at a depth of about 34 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Offenbacher soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Caris soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105 on the Offenbacher soil. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are the slope, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soils also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Pine-Douglas Fir-Fescue.

27B—Carney clay, 1 to 5 percent slopes. This moderately deep, moderately well drained soil is on alluvial fans. It formed in alluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown clay about 6 inches thick. The next layer also is dark brown clay about 6 inches thick. The subsoil is dark brown clay about 23 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Coker and Phoenix soils on concave slopes, Cove and Padigan soils on concave slopes near drainageways, Brader and Debenger soils on ridges and convex slopes, and Darow and Manita soils. Also included are small areas of soils that are similar to the Carney soil but have bedrock at a depth of more than 40 inches and Carney soils that have slopes of more than 5 percent. Included

areas make up about 20 percent of the total acreage.

Permeability is very slow in the Carney soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used mainly for hay and pasture or for tree fruit. It also is used for homesite development and livestock grazing.

This unit is suited to irrigated crops. It is limited mainly by the high content of clay, a slow rate of water intake, and droughtiness. In summer, irrigation is needed for the maximum production of most crops. Sprinkler and trickle irrigation systems are the best methods of applying water. These systems permit an even, controlled application of water, help to prevent excessive runoff, and minimize the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the very slow permeability, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land smoothing and open ditches can reduce surface wetness. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to permanent pasture. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the very slow permeability, a high shrink-swell potential, the depth to bedrock, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the very slow permeability and the depth to bedrock. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The main limitations affecting livestock grazing are compaction, the clayey surface layer, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and prairie junegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The vegetative site is Droughty Fan, 18- to 26-inch precipitation zone.

27D—Carney clay, 5 to 20 percent slopes. This moderately deep, moderately well drained soil is on alluvial fans and hillslopes. It formed in alluvium and colluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown clay about 6 inches thick. The next layer also is dark brown clay about 6 inches thick. The subsoil is dark brown clay about 23 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Coker and Phoenix soils on concave slopes; Cove and Padigan soils on concave slopes near drainageways; and Rock outcrop and Brader, Debenger, Darow, and Manita soils. Also included are small areas of soils that are similar to the Carney soil but have bedrock at a depth of less than 20 or more than 40 inches and Carney soils that have slopes of less than 5 or more than 20 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Carney soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used mainly for hay and pasture or for tree fruit. It also is used for homesite development and livestock grazing.

This unit is suited to irrigated crops. It is limited mainly by the high content of clay, a slow rate of water intake, the slope, and droughtiness. In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler and trickle irrigation systems are suitable methods of applying water. These systems permit an even, controlled application of water, help to prevent excessive runoff, and minimize the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to permanent pasture. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the very slow permeability, a high shrink-swell potential, the depth to bedrock, the slope, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the very slow permeability and the depth to bedrock. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The main limitations affecting livestock grazing are compaction, erosion, the clayey surface layer, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and prairie junegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Droughty Fan, 18- to 26-inch precipitation zone.

28D—Carney cobbly clay, 5 to 20 percent slopes. This moderately deep, moderately well drained soil is on alluvial fans and hillslopes. It formed in alluvium and colluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown cobbly clay about 6 inches thick. The next layer is dark brown clay about 6 inches thick. The subsoil also is dark brown clay. It is about 23 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Coker and Phoenix soils on concave slopes; Cove and Padigan soils on concave slopes near drainageways; Rock outcrop; Brader, Debenger, and Darow soils; and soils that are similar to the Carney soil but have bedrock at a depth of less than 20 or more than 40 inches. Also included are small areas of Carney soils that have slopes of less than 5 or more than 20 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Carney soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used mainly for livestock grazing or for hay and pasture. It also is used for homesite development.

The main limitations affecting livestock grazing are compaction, erosion, the surface layer of cobbly clay, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and prairie junegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Range seeding is suitable if the site is in poor condition. The main limitations are the surface layer of cobbly clay and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment is limited by the cobbles on the surface.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

This unit is suited to permanent pasture. It is limited mainly by the high content of clay, a slow rate of water intake, the cobbly surface layer, and the slope. The high content of clay and cobbles in the surface layer severely limits tillage and root growth. Deep cracks form as the soil dries in summer.

In summer, irrigation is needed for the maximum production of most forage crops. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the very slow permeability, a high shrink-swell potential, the depth to bedrock, low strength, and the slope.

This unit is poorly suited to standard systems of waste disposal because of the very slow permeability and the depth to bedrock. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling.

Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Removal of cobbles in disturbed areas is needed for the best results in landscaping, particularly in areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Droughty Fan, 18- to 26-inch precipitation zone.

28E—Carney cobbly clay, 20 to 35 percent slopes. This moderately deep, moderately well drained soil is on alluvial fans and hillslopes. It formed in alluvium and colluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly grasses, shrubs, and forbs.

Typically, the surface layer is dark brown cobbly clay about 6 inches thick. The next layer is dark brown clay about 6 inches thick. The subsoil also is dark brown clay. It is about 23 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Coker and Phoenix soils on concave slopes; Cove and Padigan soils on concave slopes near drainageways; Rock outcrop; and Brader, Debenger, Darow, and Manita soils. Also included are small areas of Heppsie soils on the steeper parts of the landscape, soils that are similar to the Carney soil but have bedrock at a depth of less than 20 or more than 40 inches, and Carney soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Carney soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used for livestock grazing or homesite development.

The main limitations affecting livestock grazing are compaction, erosion, the surface layer of cobbly clay, droughtiness, and the slope. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and Lemmon needlegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Range seeding is suitable if the site is in poor condition. The main limitations are the surface layer of cobbly clay, the slope, and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment and access by livestock are limited by the cobbles on the surface and the slope.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The main limitations affecting homesite development are the very slow permeability, a high shrink-swell potential, the depth to bedrock, the slope, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the very slow permeability, the depth to bedrock, and the slope. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

The slope limits the use of the steeper areas of this unit for building site development. Cuts needed to provide essentially level building sites can expose bedrock. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Removal of cobbles in disturbed areas is needed for the best results in landscaping, particularly in areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns

and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Droughty Foothill Slopes, 18- to 22-inch precipitation zone.

29D—Carney cobbly clay, high precipitation, 5 to 20 percent slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in alluvium and colluvium derived dominantly from tuff and breccia. Elevation is 2,400 to 4,000 feet. The mean annual precipitation is 30 to 35 inches, the mean annual temperature is 45 to 54 degrees F, and the average frost-free period is 120 to 150 days. The native vegetation is mainly hardwoods and conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown cobbly clay about 6 inches thick. The next layer is dark brown clay about 6 inches thick. The subsoil also is dark brown clay. It is about 23 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Rock outcrop and McMullin soils on ridges and convex slopes, Coker soils on concave slopes, Medco soils, and soils that are similar to the Carney soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Carney soils that have slopes of less than 5 or more than 20 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Carney soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used mainly for livestock grazing or wildlife habitat. It also is used for limited timber production.

This unit is poorly suited to the production of ponderosa pine. Other species that grow on this unit include Oregon white oak and California black oak. The understory vegetation includes poison-oak, California oatgrass, and Idaho fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 70. The yield at culmination of the mean annual increment is 2,750 cubic feet per acre in a fully stocked, even-aged stand of trees at 50 years and 27,520 board feet per acre (Scribner rule) at 160 years.

The main limitations affecting timber production are compaction, erosion, slumping, the clayey surface layer, the seasonal wetness, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the seasonal high water table and the clayey surface layer limit the use of equipment to dry periods. The soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

This unit is subject to severe slumping. Road failure and landslides are likely to occur after road construction. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. When wet or moist, unsurfaced roads and skid trails are sticky. They may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. Shrinking and swelling can damage roots or push seedlings out of the ground. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. The seedling mortality rate can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine seedlings.

Undesirable plants, especially grasses, limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes California oatgrass, Idaho fescue, and bluegrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Clayey Hills, 20- to 35-inch precipitation zone.

29E—Carney cobbly clay, high precipitation, 20 to 35 percent slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in alluvium and colluvium derived dominantly from tuff and breccia. Elevation is 2,400 to 4,000 feet. The mean annual precipitation is 30 to 35 inches, the mean annual temperature is 45 to 54 degrees F, and the average frost-free period is 120 to 150 days. The native vegetation is mainly hardwoods and conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown cobbly clay about 6 inches thick. The next layer is dark brown clay about 6 inches thick. The subsoil also is dark brown clay. It is about 23 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Rock outcrop and McMullin soils on ridges and convex slopes, Coker soils on concave slopes, and Medco soils. Also included are small areas of Heppsie soils on the steeper parts of the landscape, soils that are similar to the Carney soil but have bedrock at a depth of more than 40 inches, and Carney soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Carney soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used mainly for livestock grazing or wildlife habitat. It also is used for limited timber production.

This unit is poorly suited to the production of ponderosa pine. Other species that grow on this unit include Oregon white oak and California black oak. The understory vegetation includes poison-oak, California oatgrass, and Idaho fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 70. The yield at culmination of the mean annual increment is 2,750 cubic feet per acre in a fully stocked, even-aged stand of trees at 50 years and 27,520 board feet per acre (Scribner rule) at 160 years.

The main limitations affecting timber production are erosion, compaction, slumping, the clayey surface layer, seasonal wetness, the slope, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The seasonal high water table and the clayey surface layer limit the use of equipment to dry periods. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

This unit is subject to severe slumping. Road failure and landslides are likely to occur after road construction. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. When wet or moist, unsurfaced roads and skid trails are sticky. They may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. Shrinking and swelling can damage roots or push seedlings out of the ground. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. The seedling mortality rate can be reduced by providing artificial shade for seedlings.

Reforestation can be accomplished by planting ponderosa pine seedlings.

Undesirable plants, especially grasses, limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes California oatgrass, Idaho fescue, and bluegrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Clayey Hills, 20- to 35-inch precipitation zone.

30E—Carney-Tablerock complex, 20 to 35 percent slopes. This map unit is on alluvial fans and hillslopes. Elevation is 1,250 to 3,600 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 45 percent Carney soil and 35 percent Tablerock soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Coker and Phoenix soils on concave slopes; Cove and Padigan soils on concave slopes near drainageways; Rock outcrop; and Brader, Debenger, and Darow soils. Also included are small areas of soils that are similar to the Carney soil but have bedrock at a depth of less than 20 or more than 40 inches, soils that are similar to the Tablerock soil but have bedrock within a depth of 60 inches, and Carney and Tablerock soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Carney soil is moderately deep and moderately well drained. It formed in alluvium and colluvium derived dominantly from tuff and breccia. Typically, the surface layer is dark brown cobbly clay about 6 inches thick. The next layer is dark brown clay about 6 inches thick. The subsoil also is dark brown clay. It is about 23 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is very slow in the Carney soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

The Tablerock soil is very deep and moderately well drained. It formed in colluvium derived dominantly from tuff, breccia, andesite, and sandstone. Typically, the surface is covered with a layer of leaves and twigs about 1½ inches thick. The surface layer is very dark brown gravelly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly clay loam about 7 inches thick. The upper 10 inches of the subsoil is dark brown very cobbly clay loam. The next 18 inches is brown very cobbly clay. The lower 27 inches is dark yellowish brown gravelly clay loam and gravelly loam. Weathered bedrock is at a depth of about 65 inches. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is very slow in the Tablerock soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The water table fluctuates between depths of 4 and 6 feet from December through April.

This unit is used for livestock grazing and recreational development.

The main limitations affecting livestock grazing are the cobbly surface layer of the Carney soil, compaction, erosion, the slope, droughtiness, and the included areas of Rock outcrop. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and Lemmon needlegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Range seeding is suitable if the site is in poor condition. The main limitations are the surface layer of

cobbly clay in the Carney soil, the slope, droughtiness, and the included areas of Rock outcrop. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment and access by livestock are limited by the slope, the cobbles on the surface, and the included areas of Rock outcrop.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope of both soils and the depth to bedrock in the Carney soil.

If this unit is used for recreational development, the main limitations are the high content of clay, the surface layer of cobbly clay in the Carney soil, the slope, and the included areas of Rock outcrop. The Rock outcrop should be avoided unless it is to be highlighted in the development. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. A plant cover can be established and maintained through applications of fertilizer and through seeding, mulching, and shaping of the slopes. Gravel and cobbles should be removed, particularly in picnic areas and on playgrounds. The soils are sticky and plastic when wet. As a result, trafficability is restricted.

The vegetative site in areas of the Carney soil is Droughty Foothill Slopes, 18- to 22-inch precipitation zone, and the one in areas of the Tablerock soil is Droughty Fan, 18- to 26-inch precipitation zone.

31A—Central Point sandy loam, 0 to 3 percent slopes. This very deep, well drained soil is on stream terraces. It formed in alluvium derived dominantly from granitic and metamorphic rock. Elevation is 1,000 to 2,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The vegetation in areas that have not been cultivated is mainly grasses and forbs.

Typically, the surface layer is black and very dark brown sandy loam about 30 inches thick. The upper 12 inches of the subsoil is very dark grayish brown sandy loam. The lower 7 inches is dark brown sandy loam. The upper 10 inches of the substratum is dark brown gravelly sandy loam. The lower part to a depth of 67 inches is dark brown gravelly loamy sand.

Included in this unit are small areas of Evans, Newberg, and Camas soils on flood plains; Barron soils on the higher parts of the landscape; Gregory and Clawson soils on concave slopes; Kubli and Medford soils; and soils that are similar to the Central Point soil but have very gravelly layers below a depth of 30 inches. Also included are small areas of Central Point soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Central Point soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The water table fluctuates between depths of 4 and 6 feet from December through March.

This unit is used mainly for irrigated crops, such as grass seed, onions, alfalfa, and tree fruit. Other crops include strawberries, small grain, and sugar beet seed. Some areas are used for homesite development or pasture.

This unit is well suited to irrigated crops. It has few limitations. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if this unit is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes.

Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. It has few limitations. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall and droughtiness in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

32B—Clawson sandy loam, 2 to 5 percent slopes. This very deep, poorly drained soil is on alluvial fans. It formed in alluvium derived dominantly from granitic rock. Elevation is 1,000 to 1,300 feet. The mean annual precipitation is 30 to 35 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 140 to 170 days. The vegetation in areas that have not been cultivated is mainly grasses, sedges, and forbs.

Typically, the surface layer is very dark grayish brown sandy loam about 10 inches thick. The subsoil is dark grayish brown sandy loam about 35 inches thick. The substratum to a depth of 60 inches is dark grayish brown and grayish brown sandy loam. In some areas the surface layer is gravelly.

Included in this unit are small areas of Barron and Shefflein soils on convex slopes and on the higher parts of the landscape; Central Point, Kubli, and Medford soils; and soils that are similar to the Clawson soil but have gravelly layers within a depth of 40 inches. Also included are small areas of Clawson soils that have slopes of more than 5 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Clawson soil. Available water capacity is about 7 inches. The effective rooting depth is limited by the water table, which is at a depth of 1 to 3 feet from November through June. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for hay and pasture or for homesite development.

This unit is suited to hay and pasture. The main limitations are wetness in winter and spring and droughtiness in summer and fall. Tile drainage can lower the water table if a suitable outlet is available. Land smoothing and open ditches can reduce surface wetness.

In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is limited as a site for livestock watering ponds and other water impoundments because of seepage.

The main limitations affecting homesite development are wetness in winter and spring and the moderately rapid permeability.

This unit is poorly suited to standard systems of waste disposal because of the wetness. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Because of the seasonal high water table, a drainage system is needed on sites for buildings with basements and crawl spaces. The wetness can be reduced by installing drainage tile around footings. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls.

The vegetative site is Semi-Wet Meadow.

33A—Coker clay, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on alluvial fans. It formed in alluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is very dark gray clay about 20 inches thick. The next layer is very dark gray and dark grayish brown, calcareous clay about 26 inches thick. The subsoil to a depth of 70 inches is dark grayish brown, calcareous clay. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Brader, Carney, Darow, and Debenger soils on convex slopes; Cove, Gregory, and Padigan soils on concave slopes near drainageways; Medford and Phoenix soils; and soils that are similar to the Coker soil but have bedrock at a depth of 40 to 60 inches. Also included are small areas of Coker soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Coker soil. Available water capacity is about 9 inches. The effective rooting depth is limited by the water table, which is at a depth of 0.5 foot to 1.5 feet from December through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for hay and pasture or for tree fruit. It also is used for livestock grazing, small grain, and homesite development.

This unit is suited to irrigated crops. It is limited mainly by the high content of clay, a slow rate of water intake, wetness in winter and spring, and droughtiness in summer and fall. Crops that require good drainage can be grown if a properly designed drainage system is installed. The ability of tile drains to remove subsurface water from the soil is limited because of the very slow permeability.

In summer, irrigation is needed for the maximum production of most crops. Sprinkler and trickle irrigation systems are suitable. Border and contour flood systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the very slow permeability and the water table, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land smoothing and open ditches can reduce surface wetness. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to permanent pasture. Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting livestock grazing are compaction, the clayey surface layer, wetness in winter and spring, and droughtiness in summer and fall. The vegetation suitable for grazing includes California oatgrass, bluegrass, and sedge. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because this soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer, wetness in winter and spring, and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

This unit is suited to livestock watering ponds and other water impoundments.

The main limitations affecting homesite development are the wetness, a high shrink-swell potential, the very slow permeability, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the wetness and the very slow permeability. Alternative waste disposal systems may function properly on this unit. Suitable included

soils are in some areas of the unit. Onsite investigation is needed to locate such soils.

A drainage system is needed if roads or building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Semi-Wet Meadow.

33C—Coker clay, 3 to 12 percent slopes. This very deep, somewhat poorly drained soil is on alluvial fans. It formed in alluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is very dark gray clay about 20 inches thick. The next layer is very dark gray and dark grayish brown, calcareous clay about 26 inches thick. The subsoil to a depth of 70 inches is dark grayish brown, calcareous clay. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Brader, Carney, Darow, and Debenger soils on convex slopes; Cove, Gregory, and Padigan soils on concave slopes near drainageways; Medford and Phoenix soils; and soils that are similar to the Coker soil but have bedrock at a depth of 40 to 60 inches. Also included are small areas of Coker soils that have slopes of less than 3 or more than 12 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Coker soil. Available water capacity is about 9 inches. The effective rooting depth is limited by the water table, which is at a depth of 0.5 foot to 1.5 feet from December through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for hay and pasture or for tree fruit. It also is used for livestock grazing, small grain, and homesite development.

This unit is suited to irrigated crops. It is limited mainly by the high content of clay, a slow rate of water intake, wetness in winter and spring, droughtiness in summer and fall, and the slope. Crops that require good drainage can be grown if a properly designed tile drainage system is installed. The ability of tile drains to remove subsurface water from the soil is limited because of the very slow permeability.

In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler and trickle irrigation systems are the best methods of applying water. These systems permit an even, controlled application of water, help to prevent excessive runoff, and minimize the risk of erosion. Border and contour flood irrigation systems also are suitable in the less sloping areas. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. Growing a permanent cover crop helps to control runoff and reduces the hazard of erosion.

This unit is well suited to permanent pasture. Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting livestock grazing are compaction, erosion, the clayey surface layer, wetness in winter and spring, and droughtiness in summer and fall. The vegetation suitable for grazing includes California oatgrass, bluegrass, and sedge. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because this soil remains wet for long periods in spring, grazing should be delayed until the soil is firm

and the more desirable forage plants have achieved enough growth to withstand grazing pressure. Compaction can be minimized by grazing first in the areas that dry out earliest.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer, wetness in winter and spring, and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope.

The main limitations affecting homesite development are the wetness, a high shrink-swell potential, the very slow permeability, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the wetness and the very slow permeability. Alternative waste disposal systems may function properly on this unit. Suitable included soils are in some areas of the unit. Onsite investigation is needed to locate such soils.

A drainage system is needed if roads or building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Semi-Wet Meadow.

34B—Coleman loam, 0 to 7 percent slopes. This very deep, moderately well drained soil is on stream terraces. It formed in alluvium derived dominantly from sedimentary and volcanic rock. Elevation is 1,200 to 1,700 feet. The mean annual precipitation is 18 to 25 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 160 to 180 days. The vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 8 inches thick. The next layer is dark brown clay loam about 12 inches thick. The subsoil is dark brown clay about 20 inches thick. The upper 18 inches of the substratum is dark brown clay loam. The lower part to a depth of 65 inches is yellowish red clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is gravelly.

Included in this unit are small areas of Gregory and Medford soils on the lower terraces and Ruch soils on alluvial fans. Also included are small areas of Coleman soils that have slopes of more than 7 percent. Included areas make up about 15 percent of the total acreage.

Permeability is slow in the Coleman soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The water table fluctuates between depths of 1.5 and 2.0 feet from December through April.

This unit is used mainly for irrigated crops, such as alfalfa hay, tree fruit, and small grain. Other crops include corn for silage and sugar beet seed. Some areas are used for homesite development, grass hay, or pasture.

This unit is suited to irrigated crops. It is limited mainly by wetness in winter and spring and by the slow permeability. Crops that require good drainage can be grown if a properly designed tile drainage system is installed. Tile drainage can lower the water table if collection laterals are closely spaced and a suitable outlet is available. In the less sloping areas, land smoothing and open ditches can reduce surface wetness.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation, development of a perched water table, and an increase in the risk of erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet.

Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet and by planting a cover crop. Growing a permanent cover crop helps to control runoff and reduces the hazard of erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the wetness, the slow permeability, a high shrink-swell potential, and low strength.

The slow permeability and the water table increase the possibility that septic tank absorption fields will fail. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

A seasonal high water table is perched above the layer of clay; therefore, a drainage system is needed on sites for buildings with basements and crawl spaces. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the subsoil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

35A—Cove clay, 0 to 3 percent slopes. This very deep, poorly drained soil is on flood plains. It formed in alluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 2,500 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is black clay about 16 inches thick. The subsoil is very dark grayish brown silty clay about 34 inches thick. The substratum to a depth of 60 inches is dark grayish brown silty clay. The depth to bedrock is 60 inches or more. In some areas the surface layer is silty clay loam.

Included in this unit are small areas of Carney soils on convex slopes; Coker, Gregory, and Padigan soils; and soils that are similar to the Cove soil but are very gravelly within a depth of 30 inches. Also included are small areas of Cove soils that have slopes of more than 3 percent. Included areas make up about 10 percent of the total acreage.

Permeability is very slow in the Cove soil. Available water capacity is about 9 inches. The effective rooting depth is limited by the water table, which is within a depth of 1 foot from December through June. Runoff is slow, and the hazard of water erosion is slight. This soil is frequently flooded for brief periods from December through April.

This unit is used mainly for pasture. It also is used for tree fruit, grass-legume hay, and homesite development.

This unit is suited to permanent pasture. It is limited mainly by the hazard of flooding, the wetness, the high content of clay, and a slow rate of water intake. The risk of flooding can be reduced by levees, dikes, and diversions. The ability of tile drains to remove subsurface water from the soil is limited because of the very slow permeability.

In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the very slow permeability and the seasonal high water table, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land smoothing and open ditches can reduce surface wetness. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Wetness limits the choice of suitable forage plants

and the period of cutting or grazing and increases the risk of winterkill. Maintaining a protective plant cover in winter reduces the soil loss resulting from flooding. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet and by planting a cover crop. A permanent sod crop helps to control runoff.

This unit is poorly suited to homesite development. The main limitations are the flooding, the wetness, a high shrink-swell potential, and the very slow permeability.

This unit is poorly suited to standard systems of waste disposal because of the hazard of flooding, the wetness, and the very slow permeability. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

A drainage system is needed if roads or building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load. Roads and streets should be constructed above the expected level of flooding.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Poorly Drained Bottom.

36G—Coyata-Rock outcrop complex, 35 to 80 percent north slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Coyata soil and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Crater Lake, Dumont, and Reinecke soils on the less sloping parts of the landscape; soils that are similar to the Coyata soil but have bedrock at a depth of more than 40 inches; and Coyata soils that have slopes of less than 35 or more than 80 percent. Included areas make up about 20 percent of the total acreage.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown very stony loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Coyata soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are the slope, the Rock outcrop, erosion, plant competition, and seedling mortality. Also, the bedrock restricts root

growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. The Rock outcrop can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Because of the slope and the Rock outcrop, areas of this unit can hinder livestock movement.

The vegetative site is Mixed Fir-Western Hemlock Forest.

37G—Coyata-Rock outcrop complex, 35 to 80 percent south slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Coyata soil and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Crater Lake, Dumont, and Reinecke soils on the less sloping parts of the landscape; soils that are similar to the Coyata soil but have bedrock at a depth of more than 40 inches; and Coyata soils that have slopes of less than 35 or more than 80 percent. Included areas make up about 20 percent of the total acreage.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown very stony loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Coyata soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, the Rock outcrop, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. The Rock outcrop can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping

landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Because of the slope and the Rock outcrop, areas of this unit can hinder livestock movement.

The vegetative site is Mixed Fir-Mixed Pine Forest.

38C—Crater Lake-Alcot complex, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 2,000 to 3,200 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Crater Lake soil and 35 percent Alcot soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Barhiskey, Coyata, Dumont, and Reinecke soils; soils that are similar to the Crater Lake and Alcot soils but have bedrock at a depth of 40 to 60 inches; and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Crater Lake and Alcot soils that have slopes of more than 12 percent. Included areas make up about 10 percent of the total acreage.

The Crater Lake soil is very deep and well drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil also is dark yellowish brown sandy loam. It is about 17 inches thick. The substratum to a depth of 60 inches is strong brown and brown sandy loam. The depth to bedrock is 60 inches or more.

Permeability is moderately rapid in the Crater Lake soil. Available water capacity is about 12 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Alcot soil is very deep and somewhat excessively drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is brown gravelly sandy loam about 4 inches thick. The subsoil also is brown gravelly sandy loam. It is about 7 inches thick. The substratum to a depth of 60 inches is dark yellowish brown and dark grayish brown very cobbly sandy loam. The depth to bedrock is 60 inches or more.

Permeability is rapid in the Alcot soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat. It also is used for homesite development.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145 on both the Crater Lake and Alcot soils. The yield at culmination of the mean annual increment is 9,120 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 74,360 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 110.

The main limitations affecting timber production are compaction, erosion, plant competition, and seedling mortality. Conventional methods of harvesting timber generally are suitable, but the soils may be compacted

if they are moist when heavy equipment is used. Because of the high content of volcanic ash, displacement of the surface layer occurs most readily when the soils are dry. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Logging roads require suitable surfacing for year-round use. Construction and maintenance of roads may be difficult because of the volcanic ash, which is poor subgrade material because it is not easily compacted when dry, has a moderate potential for frost action, and has a high water-holding capacity. When wet or moist, unsurfaced roads and skid trails are soft. They may be impassable during rainy periods. When dry, they are very dusty.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and soil displacement. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock. Displacement of the surface layer occurs most readily when the soils are dry.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be reduced if this unit is grazed when the soils are susceptible to displacement.

This unit is suited to homesite development. The main limitations are the rapid permeability in the Alcot soil and the high content of volcanic ash and pumice in both soils. This material has a moderate potential for frost action.

In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating as soon as possible in disturbed areas around construction sites helps to control soil blowing.

Removal of large pieces of pumice in disturbed areas is needed for the best results in landscaping, particularly in areas used for lawns. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Mixed Fir-Western Hemlock Forest.

39E—Crater Lake-Alcot complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 2,000 to 3,200 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Crater Lake soil and 30 percent Alcot soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Coyata, Dumont, and Reinecke soils; Rock outcrop on convex slopes; soils that are similar to the Crater Lake and Alcot soils but have bedrock at a depth of 40 to 60 inches; and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Crater Lake and Alcot soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Crater Lake soil is very deep and well drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark yellowish

brown sandy loam about 5 inches thick. The subsoil also is dark yellowish brown sandy loam. It is about 17 inches thick. The substratum to a depth of 60 inches is strong brown and brown sandy loam. The depth to bedrock is 60 inches or more.

Permeability is moderately rapid in the Crater Lake soil. Available water capacity is about 12 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate or high.

The Alcot soil is very deep and somewhat excessively drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is brown gravelly sandy loam about 4 inches thick. The subsoil also is brown gravelly sandy loam. It is about 7 inches thick. The substratum to a depth of 60 inches is dark yellowish brown and dark grayish brown very cobbly sandy loam. The depth to bedrock is 60 inches or more.

Permeability is rapid in the Alcot soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145 on both the Crater Lake and Alcot soils. The yield at culmination of the mean annual increment is 9,120 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 74,360 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 110.

The main limitations affecting timber production are erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Because of the high content of volcanic ash, displacement of the surface layer occurs most readily when the soils are dry. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Logging roads require suitable surfacing for year-round use. Construction and maintenance of roads may be difficult because of the volcanic ash, which is poor subgrade material because it is not easily compacted when dry, has a moderate potential for frost action, and has a high water-holding capacity. When wet or moist, unsurfaced roads and skid trails are soft. They may be impassable during rainy periods. When dry, they are very dusty.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction, erosion, and soil displacement. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock. Displacement of the surface layer occurs most readily when the soils are dry.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be reduced if this unit is grazed when the soils are susceptible to displacement.

The vegetative site is Mixed Fir-Western Hemlock Forest.

40E—Crater Lake-Alcot complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 2,000 to 3,200 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Crater Lake soil and 30 percent Alcot soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Coyata, Dumont, and Reinecke soils; Rock outcrop on convex slopes; soils that are similar to the Crater Lake and Alcot soils but have bedrock at a depth of 40 to 60 inches; and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Crater Lake and Alcot soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Crater Lake soil is very deep and well drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil also is dark yellowish brown sandy loam. It is about 17 inches thick. The substratum to a depth of 60 inches is strong brown and brown sandy loam. The depth to bedrock is 60 inches or more.

Permeability is moderately rapid in the Crater Lake soil. Available water capacity is about 12 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate or high.

The Alcot soil is very deep and somewhat excessively drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is brown gravelly sandy loam about 4 inches thick. The subsoil also is brown gravelly sandy loam. It is about 7 inches thick. The substratum to a depth of 60 inches is dark yellowish brown and dark grayish brown very cobbly sandy loam. The depth to bedrock is 60 inches or more.

Permeability is rapid in the Alcot soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135 on both the Crater Lake and Alcot soils. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Because of the high content of volcanic ash, displacement of the surface layer occurs most readily when the soils are dry. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Logging roads require suitable surfacing for year-round use. Construction and maintenance of roads may be difficult because of the volcanic ash, which is poor subgrade material because it is not easily compacted when dry, has a moderate potential for frost action, and has a high water-holding capacity. When wet or moist, unsurfaced roads and skid trails are soft. They may be impassable during rainy periods. When dry, they are very dusty.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the

seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are compaction, erosion, and soil displacement. The native vegetation suitable for grazing includes western fescue, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock. Displacement of the surface layer occurs most readily when the soils are dry.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be reduced if this unit is grazed when the soils are too dry.

The vegetative site is Mixed Fir-Mixed Pine Forest.

41G—Crater Lake-Rock outcrop complex, 35 to 70 percent north slopes. This map unit is on hillslopes. Elevation is 2,000 to 3,200 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Crater Lake soil and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Alcot, Coyata, Dumont, and Reinecke soils; soils that are similar to the Crater Lake soil but have bedrock within a depth of 60 inches; and Crater Lake soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 25 percent of the total acreage.

The Crater Lake soil is very deep and well drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil also is dark yellowish brown sandy loam. It is about 17 inches thick. The substratum to a depth of 60 inches is strong brown and brown sandy loam. The depth to bedrock is 60 inches or more.

Permeability is moderately rapid in the Crater Lake soil. Available water capacity is about 12 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145 on the Crater Lake soil. The yield at culmination of the mean annual increment is 9,120 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 74,360 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 110.

The main limitations affecting timber production are the slope, the Rock outcrop, erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Because of the high content of volcanic ash, displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Logging roads require suitable surfacing for year-round use. Construction and maintenance of roads may be difficult because of the volcanic ash, which is poor subgrade material because it is not easily compacted when dry, has a moderate potential for frost action, and has a high water-holding capacity. When wet or moist, unsurfaced roads and skid trails are soft. They may be impassable during rainy periods. When dry, they are very dusty.

Properly designed road drainage systems that include carefully located culverts help to control erosion.

Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, soil displacement, the slope, and the Rock outcrop. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Displacement of the surface layer occurs most readily when the soil is dry.

Because of the slope and the Rock outcrop, areas of this unit can hinder livestock movement.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be reduced if this unit is grazed when the soil is too dry.

The vegetative site is Mixed Fir-Western Hemlock Forest.

42G—Crater Lake-Rock outcrop complex, 35 to 70 percent south slopes. This map unit is on hillslopes. Elevation is 2,000 to 3,200 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Crater Lake soil and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Alcot, Coyata, Dumont, and Reinecke soils; soils that are similar to the Crater Lake soil but have bedrock within a depth of 60 inches; and Crater Lake soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 25 percent of the total acreage.

The Crater Lake soil is very deep and well drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil also is dark yellowish brown sandy loam. It is about 17 inches thick. The substratum to a depth of 60 inches is strong brown and brown sandy loam. The depth to bedrock is 60 inches or more.

Permeability is moderately rapid in the Crater Lake soil. Available water capacity is about 12 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135 on the Crater Lake soil. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are the slope, the Rock outcrop, erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist

causes rutting and compaction. Because of the high content of volcanic ash, displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Logging roads require suitable surfacing for year-round use. Construction and maintenance of roads may be difficult because of the volcanic ash, which is poor subgrade material because it is not easily compacted when dry, has a moderate potential for frost action, and has a high water-holding capacity. When wet or moist, unsurfaced roads and skid trails are soft. They may be impassable during rainy periods. When dry, they are very dusty.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, soil displacement, the slope, and the Rock outcrop. The native vegetation suitable for grazing includes western fescue, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Displacement of the surface layer occurs most readily when the soil is dry.

Because of the slope and the Rock outcrop, areas of this unit can hinder livestock movement.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be reduced if this unit is grazed when the soil is too dry.

The vegetative site is Mixed Fir-Mixed Pine Forest.

43B—Darow silty clay loam, 1 to 5 percent slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in residuum derived dominantly from siltstone. Elevation is 1,200 to 3,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown silty clay loam about 12 inches thick. The subsoil is dark brown and dark yellowish brown silty clay about 20 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Brader and Debenger soils on ridges and convex slopes; Carney, Coker, and Selmac soils on concave slopes; Cove, Gregory, and Padigan soils near drainageways; Manita soils; and soils that are similar to the Darow soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Darow soils that have

slopes of more than 5 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Darow soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used mainly for hay and pasture or for tree fruit. It also is used for homesite development and livestock grazing.

This unit is suited to irrigated crops. It is limited mainly by the high content of clay, a slow rate of water intake, and droughtiness. In summer, irrigation is needed for the maximum production of most crops. Sprinkler and trickle irrigation systems are suitable. These systems permit an even, controlled application of water, help to prevent excessive runoff, and minimize the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the slow permeability, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land smoothing and open ditches can reduce surface wetness. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to permanent pasture. The high content of clay limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the slow permeability, a high shrink-swell potential, the depth to bedrock, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the slow permeability and the depth to bedrock. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The main limitations affecting livestock grazing are compaction, the clayey surface layer, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, California brome, and prairie junegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The vegetative site is Droughty North, 18- to 35-inch precipitation zone.

43D—Darow silty clay loam, 5 to 20 percent slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in colluvium and residuum derived dominantly from siltstone. Elevation is 1,200 to 3,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown silty clay loam about 12 inches thick. The subsoil is dark brown

and dark yellowish brown silty clay about 20 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Brader and Debenger soils on ridges and convex slopes; Carney, Coker, and Selmac soils on concave slopes; Cove, Gregory, and Padigan soils near drainageways; Manita soils; and soils that are similar to the Darow soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Darow soils that have slopes of less than 5 or more than 20 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Darow soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used mainly for hay and pasture or for tree fruit. It also is used for homesite development and livestock grazing.

This unit is suited to irrigated crops. It is limited mainly by the high content of clay, a slow rate of water intake, and droughtiness. In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler and trickle irrigation systems are the best methods of applying water. These systems permit an even, controlled application of water, help to prevent excessive runoff, and minimize the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to permanent pasture. The high content of clay limits tillage and root growth. Deep cracks form as the soil dries in summer. Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the slow permeability, a high shrink-swell potential, the slope, the depth to bedrock, and low strength.

This unit is poorly suited to standard systems of waste disposal because the slow permeability and the depth to bedrock. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The main limitations affecting livestock grazing are compaction, erosion, the clayey surface layer, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, California brome, and prairie junegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Droughty North, 18- to 35-inch precipitation zone.

43E—Darow silty clay loam, 20 to 35 percent slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in colluvium derived dominantly from siltstone. Elevation is 1,200 to 3,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown silty clay loam about 12 inches thick. The subsoil is dark brown and dark yellowish brown silty clay about 20 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Rock outcrop and Brader and Debenger soils on ridges and convex slopes; Carney, Coker, and Selmac soils on concave slopes; Cove, Gregory, and Padigan soils near drainageways; Manita soils; and soils that are similar to the Darow soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Darow soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Darow soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used mainly for homesite development or livestock grazing. It also is used for tree fruit.

The main limitations affecting homesite development are the slow permeability, a high shrink-swell potential, the slope, the depth to bedrock, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the slow permeability, the depth to bedrock, and the slope. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

The slope limits the use of the steeper areas of this unit for building site development. Cuts needed to provide essentially level building sites can expose bedrock. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The main limitations affecting livestock grazing are compaction, erosion, the clayey surface layer, droughtiness, and the slope. The vegetation suitable for grazing includes Idaho fescue, California brome, and prairie junegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment and access by livestock are limited by the slope.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer, the slope, and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soils are wet. A permanent cover crop helps to control runoff and erosion.

The vegetative site is Droughty North, 18- to 35-inch precipitation zone.

44C—Debenger-Brader loams, 1 to 15 percent slopes. This map unit is on knolls and ridges. Elevation is 1,000 to 3,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Debenger soil and 20 percent Brader soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop on convex slopes; Carney, Coker, and Darow soils on concave slopes; poorly drained soils that are similar to the Debenger soil; Padigan soils near drainageways; Langellain and Ruch soils; and soils that are similar to the Brader soil but have bedrock within a depth of 12 inches. Also included are small areas of Debenger and Brader soils that have slopes of more than 15 percent. Included areas make up about 20 percent of the total acreage.

The Debenger soil is moderately deep and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 5 inches thick. The next layer is reddish brown loam about 4 inches thick. The subsoil is reddish brown and yellowish red clay loam about 18 inches thick. Weathered bedrock is at a depth of about 27 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Debenger soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

The Brader soil is shallow and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil is dark reddish brown loam about 7 inches thick. Weathered bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the Brader soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used for hay and pasture, livestock grazing, and homesite development.

This unit is suited to irrigated hay and pasture. It is limited mainly by the depth to bedrock in the Brader soil and droughtiness in both soils. In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable in the less sloping areas. For the efficient application and removal of surface irrigation water, land leveling is needed. The bedrock underlying the Brader soil, however, may be exposed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting livestock grazing are compaction, erosion, droughtiness, and the depth to bedrock in the Brader soil. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the soils are firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitations are the depth to bedrock in the Brader soil and droughtiness in both soils. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The main limitation affecting homesite development is the depth to bedrock.

This unit is poorly suited to septic tank absorption fields because of the depth to bedrock. The absorption fields can be installed in areas of the unit where the bedrock is at a greater depth. Onsite investigation is needed to locate such areas.

Cuts needed to provide essentially level building sites can expose bedrock. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site in areas of the Debenger soil is Loamy Slopes, 18- to 24-inch precipitation zone, and

the one in areas of the Brader soil is Loamy Hills, 20- to 35-inch precipitation zone.

44E—Debenger-Brader loams, 15 to 40 percent slopes. This map unit is on knolls and ridges. Elevation is 1,000 to 3,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Debenger soil and 20 percent Brader soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop on convex slopes, Carney and Darow soils on concave slopes, Padigan soils near drainageways, Heppsie soils on the steeper parts of the landscape, and Langellain and Ruch soils. Also included are small areas of soils that are similar to the Debenger and Brader soils but have more than 35 percent rock fragments, soils that are similar to the Brader soil but have bedrock within a depth of 12 inches, and Debenger and Brader soils that have slopes of less than 15 or more than 40 percent. Included areas make up about 25 percent of the total acreage.

The Debenger soil is moderately deep and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 5 inches thick. The next layer is reddish brown loam about 4 inches thick. The subsoil is reddish brown and yellowish red clay loam about 18 inches thick. Weathered bedrock is at a depth of about 27 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Debenger soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

The Brader soil is shallow and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil is dark reddish brown loam about 7 inches thick. Weathered bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the Brader soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used mainly for livestock grazing or homesite development. Some of the less sloping areas are used for hay and pasture.

The main limitations affecting livestock grazing are compaction, erosion, droughtiness, the slope, and the depth to bedrock in the Brader soil. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment and access by livestock are limited by the slope. Constructing trails or walkways allows livestock to graze in areas where access is limited.

Range seeding is suitable if the site is in poor condition. The main limitations are the depth to bedrock in the Brader soil, droughtiness, and the slope. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The main limitations affecting homesite development are the depth to bedrock and the slope. The slope limits the use of the steeper areas of this unit for building site development. Cuts needed to provide essentially level building sites can expose bedrock. Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed.

This unit is poorly suited to septic tank absorption fields because of the depth to bedrock and the slope. The absorption fields can be installed in areas of the unit where the soils are deeper over bedrock and are less sloping. Onsite investigation is needed to locate such areas.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site in areas of the Debenger soil is Loamy Slopes, 18- to 24-inch precipitation zone, and the one in areas of the Brader soil is Loamy Hills, 20- to 35-inch precipitation zone.

45G—Donegan gravelly loam, 35 to 65 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,000 to 5,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 41 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 3 inches thick. The surface layer is dark brown gravelly loam about 10 inches thick. The next 12 inches also is dark brown gravelly loam. The subsoil is dark brown extremely gravelly loam about 10 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Killet soils on concave slopes, soils that are similar to Killet soils but have bedrock within a depth of 60 inches, Rock outcrop on convex slopes, and soils that are similar to the Donegan soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Donegan soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Donegan soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar, western hemlock, and Pacific dogwood. The understory vegetation includes cascade Oregongrape, vine maple, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 50-year site curve, the mean site index for white fir is 85. The yield at culmination of the mean annual increment is 14,420 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely

deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Western Hemlock Forest.

46G—Donegan gravelly loam, 35 to 65 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from igneous rock and volcanic ash. Elevation is 4,000 to 5,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 41 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 3 inches thick. The surface layer is dark brown gravelly loam about 10 inches thick. The next 12 inches also is dark brown gravelly loam. The subsoil is dark brown extremely gravelly loam about 10 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Killet soils on concave slopes, soils that are similar to Killet soils but have bedrock within a depth of 60 inches, Rock outcrop on convex slopes, and soils that are similar to the Donegan soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Donegan soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Donegan soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes Whipplevine, Pacific serviceberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

On the basis of a 50-year site curve, the mean site index for white fir is 80. The yield at culmination of the mean annual increment is 13,720 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial

reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

47C—Donegan-Killet gravelly loams, 3 to 12 percent slopes. This map unit is on plateaus. Elevation is 4,000 to 5,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 41 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Donegan soil and 20 percent Killet soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of poorly drained soils near drainageways and on concave slopes, soils that are similar to the Killet soil but have bedrock within a depth of 60 inches, and soils that are similar to the Donegan soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Donegan and Killet soils that have slopes of less than 3 or more than 12 percent. Included areas make up about 20 percent of the total acreage.

The Donegan soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about 3 inches thick. The surface layer is dark brown gravelly loam about 10 inches thick. The next 12 inches also is dark brown gravelly loam. The subsoil is dark brown extremely gravelly loam about 10 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Donegan soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

The Killet soil is very deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark reddish brown gravelly loam about 18 inches thick. The upper 20 inches of the subsoil is dark reddish brown gravelly clay loam. The lower 22 inches is dark reddish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Killet soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar, western hemlock, and Pacific dogwood. The understory vegetation includes cascade Oregongrape, vine maple, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Donegan soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per

acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 50-year site curve, the mean site index for white fir is 85 on the Donegan soil. The yield at culmination of the mean annual increment is 14,420 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 150 on the Killet soil. The yield at culmination of the mean annual increment is 9,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 72,400 board feet per acre (Scribner rule) at 100 years. On the basis of a 50-year curve, the mean site index is 115.

On the basis of a 50-year site curve, the mean site index for white fir is 90 on the Killet soil. The yield at culmination of the mean annual increment is 15,190 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are compaction, erosion, plant competition, and seedling mortality. Also, the bedrock underlying the Donegan soil restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Western Hemlock Forest.

48E—Donegan-Killet gravelly loams, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 4,000 to 5,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 41 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Donegan soil and 20 percent Killet soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of poorly drained soils near drainageways and on concave slopes, Rock outcrop on convex slopes, soils that are similar to the Killet soil but have bedrock within a depth of 60 inches, and soils that are similar to the Donegan soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Donegan and Killet soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Donegan soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about 3 inches thick. The surface layer is dark brown gravelly

loam about 10 inches thick. The next 12 inches also is dark brown gravelly loam. The subsoil is dark brown extremely gravelly loam about 10 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Donegan soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Killet soil is very deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark reddish brown gravelly loam about 18 inches thick. The upper 20 inches of the subsoil is dark reddish brown gravelly clay loam. The lower 22 inches is dark reddish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Killet soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar, western hemlock, and Pacific dogwood. The understory vegetation includes cascade Oregongrape, vine maple, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Donegan soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 50-year site curve, the mean site index for white fir is 85 on the Donegan soil. The yield at culmination of the mean annual increment is 14,420 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 150 on the Killet soil. The yield at culmination of the mean annual increment is 9,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 72,400 board feet per acre (Scribner rule) at 100 years. On the basis of a 50-year curve, the mean site index is 115.

On the basis of a 50-year site curve, the mean site index for white fir is 90 on the Killet soil. The yield at culmination of the mean annual increment is 15,190 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have

achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Western Hemlock Forest.

49E—Donegan-Killet gravelly loams, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 4,000 to 5,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 41 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Donegan soil and 20 percent Killet soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of poorly drained soils near drainageways and on concave slopes, Rock outcrop on convex slopes, soils that are similar to the Killet soil but have bedrock within a depth of 60 inches, and soils that are similar to the Donegan soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Donegan and Killet soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Donegan soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about 3 inches thick. The surface layer is dark brown gravelly loam about 10 inches thick. The next 12 inches also is dark brown gravelly loam. The subsoil is dark brown extremely gravelly loam about 10 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Donegan soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Killet soil is very deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark reddish brown gravelly loam about 18 inches thick. The upper 20 inches of the subsoil is dark reddish brown gravelly clay loam. The lower 22 inches is dark reddish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Killet soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes Whipplevine, Pacific serviceberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135 on the Donegan soil. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

On the basis of a 50-year site curve, the mean site index for white fir is 80 on the Donegan soil. The yield at culmination of the mean annual increment is 13,720 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Killet soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 50-year site curve, the mean site index for white fir is 85 on the Killet soil. The yield at culmination of the mean annual increment is 14,420 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock underlying the Donegan soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and

compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Donegan soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

50E—Dubakella very stony clay loam, rocky, 12 to 35 percent slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from peridotite and serpentinite. Elevation is 1,200 to 4,100 feet. The mean annual precipitation is 35 to 60 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark reddish brown very stony clay loam about 11 inches thick. The subsoil is dark reddish brown very cobbly clay about 20 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Pearsoll soils and Rock outcrop on ridges and convex slopes; Acker, Gravecreek, Josephine, Norling, and Speaker soils; and, on concave slopes and foot slopes, soils that are similar to the Dubakella soil but have bedrock at a depth of more than 40 inches. Also included are Dubakella soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 25 percent of the total acreage.

Permeability is slow in the Dubakella soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is poorly suited to timber production. The species that grow on this unit include Douglas fir, incense cedar, Jeffrey pine, and Pacific madrone. The understory vegetation includes canyon live oak, common snowberry, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 80. The yield at culmination of the mean annual increment is 4,060 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 23,360 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

The main limitations affecting timber production are low fertility, erosion, compaction, seedling mortality, and plant competition.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Rock outcrop and stones can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use. Cutbanks occasionally slump when the soil is saturated.

A high temperature in the surface layer during summer, the large number of rock fragments in the soil, and the low available water capacity increase the seedling mortality rate. A high content of magnesium and low content of calcium also increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Jeffrey pine and incense cedar seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Pine Forest, Serpentine.

50G—Dubakella very stony clay loam, rocky, 35 to 70 percent slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from peridotite and serpentinite. Elevation is 1,200 to 4,100 feet. The mean annual precipitation is 35 to 60 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark reddish brown very stony clay loam about 11 inches thick. The subsoil is dark reddish brown very cobbly clay about 20 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Pearsoll soils and Rock outcrop on ridges and convex slopes; Acker, Beekman, Gravecreek, Josephine, Norling, and Speaker soils; and, on concave slopes and foot slopes, soils that are similar to the Dubakella soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Dubakella soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 25 percent of the total acreage.

Permeability is slow in the Dubakella soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is poorly suited to timber production. The species that grow on this unit include Douglas fir, incense cedar, Jeffrey pine, and Pacific madrone. The understory vegetation includes canyon live oak, common snowberry, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 80. The yield at culmination of the mean annual increment is 4,060 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 23,360 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

The main limitations affecting timber production are the slope, low fertility, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Rock outcrop and stones can cause breakage of falling timber and can

hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer, the large number of rock fragments in the soil, and the low available water capacity increase the seedling mortality rate. A high content of magnesium and low content of calcium also increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Jeffrey pine and incense cedar seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Pine Forest, Serpentine.

51C—Dumont gravelly clay loam, 1 to 12 percent slopes. This very deep, well drained soil is on foot slopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 2,400 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly clay loam about 4 inches thick. The next layer is dark reddish brown clay loam about 11 inches thick. The upper 36 inches of the subsoil is yellowish red clay. The lower 9 inches is yellowish red clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Included in this unit are small areas of Acker soils, Norling soils on the more sloping parts of the landscape and on convex slopes, and poorly drained soils near drainageways. Also included are small areas of Dumont soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, western hemlock, and Pacific madrone. The understory vegetation includes golden chinkapin, salal, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are compaction, erosion, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by

using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Mixed Fir-Salal (rhododendron) Forest.

52C—Dumont-Coyata gravelly loams, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Dumont soil and 35 percent Coyata soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Reinecke soils, Terrabella soils near drainageways and on concave slopes, and soils that are similar to the Dumont soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Dumont and Coyata soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

The Dumont soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The next layer is dark reddish brown clay loam about 9 inches thick. The subsoil is dark reddish brown clay about 42 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Dumont soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Coyata soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are compaction, erosion, plant competition, and seedling mortality. Also, the bedrock underlying the Coyata soil restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction.

Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Coyata soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Western Hemlock Forest.

53E—Dumont-Coyata gravelly loams, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Dumont soil and 25 percent Coyata soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Reinecke soils, Alcot and Crater Lake soils on concave slopes, Terrabella soils near drainageways and on concave slopes, Rock outcrop on ridges and convex slopes, and soils that are similar to the Dumont soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Dumont and Coyata soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Dumont soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The next layer is dark reddish brown clay loam about 9 inches thick. The subsoil is dark reddish brown clay about 42 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir.

Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Dumont soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Coyata soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock underlying the Coyata soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Coyata soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Western Hemlock Forest.

53G—Dumont-Coyata gravelly loams, 35 to 60 percent north slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Dumont soil and 35 percent Coyata soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop on ridges and convex slopes and soils that are similar to the Dumont soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Dumont and Coyata soils that have slopes of less than 35 or more than 60

percent. Included areas make up about 15 percent of the total acreage.

The Dumont soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The next layer is dark reddish brown clay loam about 9 inches thick. The subsoil is dark reddish brown clay about 42 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Dumont soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Coyata soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock underlying the Coyata soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Coyata soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is

harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Western Hemlock Forest.

54E—Dumont-Coyata gravelly loams, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Dumont soil and 30 percent Coyata soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Reinecke soils, Alcot and Crater Lake soils on concave slopes, Terrabella soils near drainageways and on concave slopes, Rock outcrop on ridges and convex slopes, and soils that are similar to the Dumont soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Dumont and Coyata soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Dumont soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The next layer is dark reddish brown clay loam about 9 inches thick. The subsoil is dark reddish brown clay about 42 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, ponderosa pine, sugar pine, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135 on the Dumont soil. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Coyata soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock underlying the Coyata soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less

surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Coyata soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

54G—Dumont-Coyata gravelly loams, 35 to 60 percent south slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Dumont soil and 35 percent Coyata soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop on ridges and convex slopes and soils that are similar to the Dumont soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Dumont and Coyata soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 15 percent of the total acreage.

The Dumont soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The next layer is dark reddish brown clay loam about 9 inches thick. The subsoil is dark reddish brown clay about 42 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches

thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, ponderosa pine, sugar pine, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135 on the Dumont soil. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Coyata soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock underlying the Coyata soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Coyata soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants

increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

55A—Evans loam, 0 to 3 percent slopes. This very deep, well drained soil is on flood plains. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown loam about 38 inches thick. The substratum to a depth of 60 inches is dark brown loam. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Abin, Camas, and Newberg soils and Riverwash; Cove soils on concave slopes; Central Point, Medford, and Takilma soils on terraces; and soils that are similar to the Evans soil but have a gravelly or very gravelly substratum. Also included are small areas of Evans soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Evans soil. Available water capacity is about 11 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. This soil is occasionally flooded for brief periods from December through March.

This unit is used mainly for irrigated crops, such as alfalfa hay and small grain. Other crops include corn for silage and tree fruit. Some areas are used for grass-legume hay, pasture, or homesite development.

This unit is well suited to irrigated crops. It is limited mainly by the hazard of flooding. This hazard can be reduced by levees, dikes, and diversions.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet and by planting a cover crop. A permanent sod crop helps to control runoff.

Maintaining a protective plant cover in winter reduces the soil loss resulting from flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main hazard affecting homesite development is the flooding, which limits the suitability for septic tank absorption fields. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils. Dikes and channels that have outlets for floodwater can protect buildings and onsite sewage disposal systems from flooding.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

Roads and streets should be constructed above the expected level of flooding. The risk of flooding has been reduced in some areas by the construction of large dams and reservoirs upstream.

The vegetative site is Loamy Flood Plain, 18- to 30-inch precipitation zone.

56C—Farva very cobbly loam, 3 to 12 percent slopes. This moderately deep, well drained soil is on plateaus. It formed in colluvium derived from andesite, basalt, and volcanic ash. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days.

The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown very cobbly loam about 12 inches thick. The subsoil is brown extremely cobbly loam about 15 inches thick. The substratum also is brown extremely cobbly loam. It is about 8 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Kanutchan and Sibannac soils in basins and near drainageways; Bybee, Pinehurst, and Tatouche soils on concave slopes; Woodseye soils and Rock outcrop on convex slopes; and soils that are similar to the Farva soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Farva soils that have slopes of less than 3 or more than 12 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Farva soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include Pacific yew. The understory vegetation includes cascade Oregongrape and American twinflower.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80.

On the basis of a 50-year site curve, the mean site index for white fir is 65. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Yew Forest.

57E—Farva very cobbly loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite, basalt, and volcanic ash. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less

than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown very cobbly loam about 12 inches thick. The subsoil is brown extremely cobbly loam about 15 inches thick. The substratum also is brown extremely cobbly loam. It is about 8 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Kanutchan and Sibannac soils in basins and near drainageways; Bybee, Pinehurst, and Tatouche soils on concave slopes; Woodseye soils and Rock outcrop on ridges and convex slopes; and soils that are similar to the Farva soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Farva soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Farva soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include Pacific yew. The understory vegetation includes cascade Oregongrape, and American twinflower.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,980 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 50-year site curve, the mean site index for white fir is 65. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Yew Forest.

57G—Farva very cobbly loam, 35 to 65 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite, basalt, and volcanic ash. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown very cobbly loam about 12 inches thick. The subsoil is brown extremely cobbly loam about 15 inches thick. The substratum also is brown extremely cobbly loam. It is about 8 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Pinehurst and Tatouche soils on the less sloping parts of the landscape, Woodseye soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Farva soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Farva soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Farva soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include Pacific yew. The understory vegetation includes cascade Oregongrape, and American twinflower.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,980 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 50-year site curve, the mean site index for white fir is 65. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper

livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Yew Forest.

58E—Farva very cobbly loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite, basalt, and volcanic ash. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown very cobbly loam about 12 inches thick. The subsoil is brown extremely cobbly loam about 15 inches thick. The substratum also is brown extremely cobbly loam. It is about 8 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Kanutchan and Sibannac soils in basins and near drainageways; Bybee, Pinehurst, and Tatouche soils on concave slopes; Woodseye soils and Rock outcrop on ridges and convex slopes; and soils that are similar to the Farva soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Farva soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Farva soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include ponderosa pine and incense cedar. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 50-year site curve, the mean site index for white fir is 65. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

58G—Farva very cobbly loam, 35 to 65 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite, basalt, and volcanic ash. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown very cobbly loam about 12 inches thick. The subsoil is brown extremely cobbly loam about 15 inches thick. The substratum also is brown extremely cobbly loam. It is about 8 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Pinehurst and Tatouche soils on the less sloping parts of the landscape, Woodseye soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Farva soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Farva soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Farva soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include ponderosa pine and incense cedar. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 50-year site curve, the mean site index for white fir is 65. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding

paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

59G—Farva-Rock outcrop complex, 35 to 70 percent north slopes. This map unit is on hillslopes. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 70 percent Farva soil and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Pinehurst and Tatouche soils on the less sloping parts of the landscape, Woodseye soils on ridges and convex slopes, and soils that are similar to the Farva soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Farva soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 10 percent of the total acreage.

The Farva soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, basalt, and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown very cobbly loam about 12 inches thick. The subsoil is brown extremely cobbly loam about 15 inches thick. The substratum also is brown extremely cobbly loam. It is about 8 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Farva soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include Pacific yew. The understory vegetation includes cascade Oregongrape and American twinflower.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Farva soil. The yield

at culmination of the mean annual increment is 5,980 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 50-year site curve, the mean site index for white fir is 65 on the Farva soil. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, the Rock outcrop, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. The Rock outcrop can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, the slope, and the Rock outcrop. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

Because of the slope and the Rock outcrop, areas of this unit can hinder livestock movement.

The vegetative site is Mixed Fir-Yew Forest.

60G—Farva-Rock outcrop complex, 35 to 70 percent south slopes. This map unit is on hillslopes. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 70 percent Farva soil and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Pinehurst and Tatouche soils on the less sloping parts of the landscape, Woodseye soils on ridges and convex slopes, and soils that are similar to the Farva soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Farva soils that have slopes of less than 35 or more than 70 percent. Included areas

make up about 10 percent of the total acreage.

The Farva soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, basalt, and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown very cobbly loam about 12 inches thick. The subsoil is brown extremely cobbly loam about 15 inches thick. The substratum also is brown extremely cobbly loam. It is about 8 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Farva soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include ponderosa pine and incense cedar. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Farva soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 50-year site curve, the mean site index for white fir is 65 on the Farva soil. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, the Rock outcrop, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. The Rock outcrop can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, the slope, and the Rock outcrop. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

Because of the slope and the Rock outcrop, areas of this unit can hinder livestock movement.

The vegetative site is Mixed Fir-Serviceberry Forest.

61A—Foehlin gravelly loam, 0 to 3 percent slopes. This very deep, well drained soil is on stream terraces. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 2,500 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The vegetation in areas that have not been cultivated is mainly grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown gravelly loam about 4 inches thick. The next layer is very dark grayish brown clay loam about 15 inches thick. The subsoil to a depth of 60 inches is dark brown, brown, and dark yellowish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is not gravelly.

Included in this unit are small areas of Evans, Newberg, and Camas soils on flood plains; Gregory soils on concave slopes and near drainageways; Ruch soils on alluvial fans; Takilma, Medford, and Central Point soils; and soils that are similar to the Foehlin soil but have strata of sand and gravel at a depth of more than 40 inches. Also included are small areas of Foehlin soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Foehlin soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated crops, such as alfalfa hay, tree fruit, and small grain. Other crops include corn for silage and sugar beet seed. Some areas are used for homesite development, grass-legume hay, or pasture.

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet and by planting a cover crop. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. The main limitation is the moderately slow permeability. If the soil is used as a site for septic tank absorption fields, the moderately slow permeability can be overcome by increasing the size of the absorption field.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

62C—Freezener gravelly loam, 1 to 12 percent slopes. This very deep, well drained soil is on plateaus. It formed in residuum and colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes, Geppert soils on the more sloping parts of the landscape and on convex slopes, and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include sugar pine, ponderosa pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

The main limitations affecting timber production are compaction, erosion, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

63E—Freezener gravelly loam, 12 to 35 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average

frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes, Geppert soils on the more sloping parts of the landscape and on convex slopes, and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific dogwood. The understory vegetation includes Pacific serviceberry, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

The main limitations affecting timber production are erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Dogwood Forest.

64E—Freezener gravelly loam, 12 to 35 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about

9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes, Geppert soils on the more sloping parts of the landscape and on convex slopes, and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include sugar pine, ponderosa pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

65C—Freezener-Geppert complex, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 65 percent Freezener soil and 30 percent Geppert soil. The components of this unit occur

as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener and Geppert soils that have slopes of more than 12 percent. Included areas make up about 5 percent of the total acreage.

The Freezener soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Geppert soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include sugar pine, ponderosa pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Freezener soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Geppert soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are compaction, erosion, plant competition, and seedling mortality. Also, the bedrock underlying the Geppert soil restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Geppert soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed,

the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

66E—Freezener-Geppert complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 65 percent Freezener soil and 30 percent Geppert soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener and Geppert soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 5 percent of the total acreage.

The Freezener soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Geppert soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific dogwood. The understory vegetation includes Pacific serviceberry, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Freezener soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Geppert soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock underlying the Geppert soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least

susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Geppert soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Dogwood Forest.

66G—Freezener-Geppert complex, 35 to 60 percent north slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 65 percent Freezener soil and 30 percent Geppert soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener and Geppert soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 5 percent of the total acreage.

The Freezener soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Geppert soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific dogwood. The understory vegetation includes Pacific serviceberry, cascade

Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Freezener soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Geppert soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock underlying the Geppert soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Geppert soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Dogwood Forest.

67E—Freezener-Geppert complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 65 percent Freezener soil and 30 percent Geppert soil. The components of this unit occur as areas so intricately intermingled that mapping them

separately was not practical at the scale used.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener and Geppert soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 5 percent of the total acreage.

The Freezener soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Geppert soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include sugar pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Freezener soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the Geppert soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock underlying the Geppert soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Geppert soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are

compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

67G—Freezener-Geppert complex, 35 to 60 percent south slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 65 percent Freezener soil and 30 percent Geppert soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener and Geppert soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 5 percent of the total acreage.

The Freezener soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Geppert soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include sugar pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Freezener soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the Geppert soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock underlying the Geppert soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and

helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Geppert soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

68C—Geppert very cobbly loam, 1 to 12 percent slopes. This moderately deep, well drained soil is on plateaus. It formed in colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes, Freezener soils on concave slopes, Rock outcrop on convex slopes, and soils that are similar to the Geppert soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Geppert soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include sugar pine, ponderosa pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre

in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are compaction, erosion, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

69E—Geppert very cobbly loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes, Freezener soils on concave slopes, Rock outcrop on ridges and convex slopes, and soils that are similar to the Geppert soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Geppert soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific dogwood. The understory vegetation includes Pacific serviceberry, cascade

Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Dogwood Forest.

69G—Geppert very cobbly loam, 35 to 70 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Freezener soils on the less sloping parts of the landscape, Rock outcrop on ridges and convex slopes, and soils that are similar to the Geppert soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Geppert soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific dogwood. The understory vegetation includes Pacific serviceberry, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Dogwood Forest.

70E—Geppert very cobbly loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish

brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes, Freezener soils on concave slopes, Rock outcrop on ridges and convex slopes, and soils that are similar to the Geppert soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Geppert soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include sugar pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

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Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

70G—Geppert very cobbly loam, 35 to 60 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual

temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Freezener soils on the less sloping parts of the landscape, Rock outcrop on ridges and convex slopes, and soils that are similar to the Geppert soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Geppert soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include sugar pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

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Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the

understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

71E—Goolaway silt loam, 20 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from schist. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Josephine, Siskiyou, and Speaker soils; Musty soils on ridges and convex slopes; Pollard soils on the less sloping parts of the landscape and on concave slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Goolaway soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Goolaway soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and sugar pine. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are erosion, compaction, slumping, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

71F—Goolaway silt loam, 35 to 50 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from schist. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Josephine, Siskiyou, and Speaker soils; Musty soils on ridges and convex slopes; Pollard soils on the less sloping parts of the landscape and on concave slopes; and soils that are similar to the Goolaway soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Goolaway soils that have slopes of less than 35 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and sugar pine. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are the slope, erosion, compaction, slumping, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

72E—Goolaway silt loam, 20 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from schist. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of

needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Josephine, Siskiyou, and Speaker soils; Musty soils on ridges and convex slopes; Pollard soils on the less sloping parts of the landscape and on concave slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Goolaway soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Goolaway soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are erosion, compaction, slumping, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Black Oak Forest.

72F—Goolaway silt loam, 35 to 50 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from schist. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Josephine,

Siskiyou, and Speaker soils; Musty soils on ridges and convex slopes; Pollard soils on the less sloping parts of the landscape and on concave slopes; and soils that are similar to the Goolaway soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Goolaway soils that have slopes of less than 35 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, compaction, slumping, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Black Oak Forest.

73E—Goolaway-Pollard complex, 7 to 30 percent slopes. This map unit is on hillslopes and alluvial fans. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Goolaway soil and 25 percent Pollard soil. The Goolaway soil has slopes of more than 12 percent. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Josephine, Speaker, and Wolfpeak soils; poorly drained soils near drainageways and on concave slopes; soils that are similar to the Goolaway soil but have bedrock at a depth of more than 40 inches; and Goolaway soils that have slopes of more than 30 percent. Also included are

small areas of Pollard soils that have slopes of less than 7 percent. Included areas make up about 20 percent of the total acreage.

The Goolaway soil is moderately deep and well drained. It formed in colluvium derived dominantly from schist. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Pollard soil is very deep and well drained. It formed in alluvium and colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark brown loam about 11 inches thick. The upper 25 inches of the subsoil is dark reddish brown clay loam. The lower 25 inches is yellowish red and brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam or gravelly loam.

Permeability is slow in the Pollard soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar and sugar pine. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Goolaway soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 95.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Pollard soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are erosion, compaction, slumping, plant competition, and seedling mortality. Also, the bedrock underlying the Goolaway soil restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate, especially on south- and southwest-facing slopes. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

74F—Gravecreek gravelly loam, 35 to 55 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from serpentinitic rock. Elevation is 2,200 to 4,300 feet. The mean annual precipitation is 45 to 55 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown and dark brown gravelly loam about 7 inches thick. The upper 8 inches of the subsoil is brown very gravelly clay loam. The lower 14 inches is light olive brown very cobbly clay loam. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Acker, Dubakella, and Norling soils; Rock outcrop and Pearsoll soils on ridges and convex slopes; Dumont soils on concave slopes and on the less sloping parts of the landscape; and, on concave slopes and foot slopes, soils that are similar to the Gravecreek soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Gravecreek soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Gravecreek soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, Jeffrey pine, sugar pine, and Pacific madrone. The understory vegetation includes cascade Oregongrape, common beargrass, and creambush oceanspray.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high content of magnesium and low content of calcium increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. Reforestation can be accomplished by planting Jeffrey pine, ponderosa pine, and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Beargrass Forest, Serpentine.

74G—Gravecreek gravelly loam, 55 to 80 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from serpentinitic rock. Elevation is 2,200 to 4,300 feet. The mean annual precipitation is 45 to 55 inches, the mean annual temperature is 45 to 50 degrees F, and the

average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown and dark brown gravelly loam about 7 inches thick. The upper 8 inches of the subsoil is brown very gravelly clay loam. The lower 14 inches is light olive brown very cobbly clay loam. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Acker, Dubakella, and Norling soils; Rock outcrop and Pearsoll soils on ridges and convex slopes; and soils that are similar to the Gravecreek soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Gravecreek soils that have slopes of less than 55 or more than 80 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Gravecreek soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, Jeffrey pine, sugar pine, and Pacific madrone. The understory vegetation includes cascade Oregongrape, common beargrass, and creambush oceanspray.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are the slope, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts on this unit expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes (fig. 8). Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high content of magnesium and low content of calcium increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. Reforestation can be accomplished by planting Jeffrey pine, ponderosa pine, and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Beargrass Forest, Serpentine.

75E—Gravecreek cobbly loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes and ridges. It formed in colluvium derived from serpentinitic rock. Elevation is 2,200 to 4,300 feet. The mean annual precipitation is 45 to 55 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown cobbly loam about 3 inches thick. The next layer is dark brown gravelly loam about 4 inches thick. The upper 8 inches of the subsoil is brown very gravelly clay loam. The lower 14 inches is light olive brown very cobbly clay loam. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very cobbly or stony.

Figure 8.—Cut slope slumping onto a road in an area of Gravecreek gravelly loam, 55 to 80 percent north slopes.

Included in this unit are small areas of Acker, Dubakella, Dumont, and Norling soils; Rock outcrop and Pearsoll soils on ridges and convex slopes; poorly drained soils on concave slopes and near drainageways; and, on concave slopes and foot slopes, soils that are similar to the Gravecreek soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Gravecreek soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Gravecreek soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, Jeffrey pine, and Pacific madrone. The understory vegetation includes canyon live oak, common beargrass, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160

years. On the basis of a 50-year curve, the mean site index is 65.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. In some areas stones on the surface can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer, the low available water capacity, and a nutrient imbalance caused by the serpentinitic rock increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Jeffrey pine, ponderosa pine, and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Beargrass Forest, Serpentine.

75F—Gravecreek cobbly loam, 35 to 55 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from serpentinitic rock. Elevation is 2,200 to 4,300 feet. The mean annual precipitation is 45 to 55 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown cobbly loam about 3 inches thick. The next layer is dark brown gravelly loam about 4 inches thick. The upper 8 inches of the subsoil is brown very gravelly clay loam. The lower 14 inches is light olive brown very cobbly clay loam. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Acker, Dubakella, and Norling soils; Rock outcrop and Pearsoll soils on ridges and convex slopes; Dumont soils on concave slopes and on the less sloping parts of the landscape; and, on concave slopes and foot slopes, soils that are similar to the Gravecreek soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Gravecreek soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Gravecreek soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, Jeffrey pine, and Pacific madrone. The understory vegetation includes canyon live oak, common beargrass, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. In some

areas stones on the surface can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer, the low available water capacity, and a nutrient imbalance caused by the serpentinitic rock increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Jeffrey pine, ponderosa pine, and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Beargrass Forest, Serpentine.

75G—Gravecreek cobbly loam, 55 to 80 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from serpentinitic rock. Elevation is 2,200 to 4,300 feet. The mean annual precipitation is 45 to 55 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown cobbly loam about 3 inches thick. The next layer is dark brown gravelly loam about 4 inches thick. The upper 8 inches of the subsoil is brown very gravelly clay loam. The lower 14 inches is light olive brown very cobbly clay loam. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Acker, Dubakella, and Norling soils; Rock outcrop and Pearsoll soils on ridges and convex slopes; and soils that are similar to the Gravecreek soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Gravecreek soils that have slopes of less than 55 or more than 80 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Gravecreek soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, Jeffrey pine, and Pacific madrone. The understory vegetation includes canyon live oak, common beargrass, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

The main limitations affecting timber production are the slope, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. In some areas stones

on the surface can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts on this unit expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer, the low available water capacity, and a nutrient imbalance caused by the serpentinitic rock increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Jeffrey pine, ponderosa pine, and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Beargrass Forest, Serpentine.

76A—Gregory silty clay loam, 0 to 3 percent slopes. This deep, poorly drained soil is on stream terraces. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 2,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is very dark grayish brown silty clay loam about 7 inches thick. The next layer is very dark grayish brown clay loam about 5 inches thick. The upper 6 inches of the subsoil also is very dark grayish brown clay loam. The lower 26 inches is very dark grayish brown and dark grayish brown clay. The substratum is dark grayish brown sandy clay loam about 6 inches thick. Weathered bedrock is at a depth of about 50 inches. The depth to bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Coleman and Medford soils on the higher terraces; Brader, Debenger, and Langellain soils on convex slopes; Cove and Padigan soils; and soils that are similar to the Gregory soil but have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Gregory soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Gregory soil. Available water capacity is about 9 inches. The effective rooting depth is limited by the water table, which is within a depth of 1 foot from December through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for pasture. It also is used for irrigated crops, such as tree fruit, small grain, and corn for silage. A few areas are used for grass-legume hay or for homesite development.

This unit is suited to permanent pasture. It is limited mainly by the wetness, the high content of clay, and a slow rate of water intake. Crops that require good drainage can be grown if a properly designed drainage system is installed. The ability of tile drains to remove subsurface water from the soil is limited because of the slow permeability.

In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. Furrow, border, corrugation, and trickle irrigation systems also are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the slow permeability and the water table, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land smoothing and open ditches can reduce surface wetness. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Wetness limits the choice of suitable forage plants

and the period of cutting or grazing and increases the risk of winterkill. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet and by planting a cover crop. A permanent sod crop helps to control runoff.

This unit is poorly suited to homesite development. The main limitations are the wetness, a high shrink-swell potential, the slow permeability, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the wetness and the slow permeability. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

A drainage system is needed if roads or building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Poorly Drained Bottom.

77F—Greystoke stony loam, 35 to 55 percent north slopes. This deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 3,000 to 4,800 feet. The mean annual precipitation is 20 to 30 inches, the mean annual temperature is 42 to 46 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is dark reddish brown very cobbly loam about 10 inches thick. The upper 10 inches of the subsoil also is dark reddish brown very cobbly loam. The lower 19 inches is dark reddish brown extremely gravelly clay loam. Weathered bedrock is at a depth of about 42 inches. The depth to bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Merlin and Royst soils, Rock outcrop and Rubble land on ridges and convex slopes, Pinehurst soils on the less sloping parts of the landscape, and soils that are similar to the Greystoke soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Greystoke soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Greystoke soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, white fir, and sugar pine. The understory vegetation includes tall Oregon grape, pachystima, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are the slope, erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard

wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir-Mixed Pine-Sedge Forest.

77G—Greystoke stony loam, 55 to 75 percent north slopes. This deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 3,000 to 4,800 feet. The mean annual precipitation is 20 to 30 inches, the mean annual temperature is 42 to 46 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is dark reddish brown very cobbly loam about 10 inches thick. The upper 10 inches of the subsoil also is dark reddish brown very cobbly loam. The lower 19 inches is dark reddish brown extremely gravelly clay loam. Weathered bedrock is at a depth of about 42 inches. The depth to bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Merlin and Royst soils, Rock outcrop and Rubble land on ridges and convex slopes, Pinehurst soils on the less sloping parts of the landscape, and soils that are similar to the Greystoke soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Greystoke soils that have slopes of less than 55 or more than 75 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Greystoke soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, white fir, and sugar pine. The understory vegetation includes tall Oregon grape, pachystima, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160

years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are the slope, erosion, and plant competition. The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir-Mixed Pine-Sedge Forest.

78F—Greystoke stony loam, 35 to 55 percent south slopes. This deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 3,000 to 5,200 feet. The mean annual precipitation is 20 to 30 inches, the mean annual temperature is 42 to 46 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is dark reddish brown very cobbly loam about 10 inches thick. The upper 10 inches of the subsoil also is dark reddish brown very cobbly loam. The lower 19 inches is dark reddish brown extremely gravelly clay loam. Weathered bedrock is at a depth of about 42 inches. The depth to bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Merlin and Royst soils, Rock outcrop and Rubble land on ridges and convex slopes, Pinehurst soils on the less sloping parts of the landscape, and soils that are similar to the Greystoke soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Greystoke soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Greystoke soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, white fir, and sugar pine.

The understory vegetation includes tall Oregon grape, pachystima, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 80. The yield at culmination of the mean annual increment is 2,670 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 33,750 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir-Mixed Pine-Sedge Forest.

79E—Greystoke-Pinehurst complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 3,500 to 4,800 feet. The mean annual precipitation is 20 to 30 inches, the mean annual temperature is 42 to 46 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Greystoke soil and 25 percent Pinehurst soil. The components of this unit occur as areas so intricately intermingled that mapping

them separately was not practical at the scale used.

Included in this unit are small areas of Merlin and Royst soils and Rock outcrop on ridges and convex slopes, Kanutchan soils near drainageways and on concave slopes, and soils that are similar to the Pinehurst soil but have bedrock within a depth of 60 inches. Also included are small areas of Greystoke and Pinehurst soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Greystoke soil is deep and well drained. It formed in residuum and colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is dark reddish brown very cobbly loam about 10 inches thick. The upper 10 inches of the subsoil also is dark reddish brown very cobbly loam. The lower 19 inches is dark reddish brown extremely gravelly clay loam. Weathered bedrock is at a depth of about 42 inches. The depth to bedrock ranges from 40 to 60 inches.

Permeability is moderately slow in the Greystoke soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Pinehurst soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 15 inches thick. The subsoil is dark reddish brown clay loam about 45 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Pinehurst soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, white fir, and sugar pine. The understory vegetation includes tall Oregon grape, pachystima, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90 on the Greystoke soil. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90 on the Greystoke soil. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Pinehurst soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 95 on the Pinehurst soil. The yield at culmination of the mean annual increment is 3,760 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 43,160 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. In the less

sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir-Mixed Pine-Sedge Forest.

80E—Greystoke-Pinehurst complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 3,500 to 4,800 feet. The mean annual precipitation is 20 to 30 inches, the mean annual temperature is 42 to 46 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Greystoke soil and 25 percent Pinehurst soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Merlin and Royst soils and Rock outcrop on ridges and convex slopes, Kanutchan soils near drainageways and on concave slopes, and soils that are similar to the Pinehurst soil but have bedrock within a depth of 60 inches. Also included are small areas of Greystoke and Pinehurst soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Greystoke soil is deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is dark reddish brown very cobbly loam about 10 inches thick. The upper 10 inches of the subsoil also is dark reddish brown very cobbly loam. The lower 19 inches is dark reddish brown extremely gravelly clay loam. Weathered bedrock is at a depth of about 42 inches. The depth to bedrock ranges from 40 to 60 inches.

Permeability is moderately slow in the Greystoke soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Pinehurst soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 15 inches thick. The subsoil is dark reddish brown clay loam about 45 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Pinehurst soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, white fir, and sugar pine. The understory vegetation includes tall Oregon grape, pachystima, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85 on the Greystoke soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 37,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 80 on the Greystoke soil. The yield at culmination of the mean annual increment is 2,670 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 33,750 board feet per acre (Scribner rule) at 150 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the Pinehurst soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 85 on the Pinehurst soil. The yield at culmination of the mean annual increment is 3,080 cubic feet per acre in a fully stocked, even-

aged stand of trees at 40 years and 38,700 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Greystoke soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir-Mixed Pine-Sedge Forest.

81G—Heppsie clay, 35 to 70 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from tuff, breccia, and andesite. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 170 days. The native vegetation is mainly hardwoods and conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown and very dark grayish brown clay about 15 inches thick. The subsoil is dark brown gravelly clay about 9 inches thick. Weathered bedrock is at a depth of about 24 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Rock outcrop and McMullin soils; Carney and Medco soils on concave slopes and on the less sloping parts of the landscape; McNull, Skookum, and Tablerock soils; and, on ridges and convex slopes, soils that are similar to the Heppsie soil but have bedrock within a depth of 20 inches. Also included are small areas of Heppsie soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Heppsie soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing

are erosion, compaction, the slope, droughtiness, and the clayey surface layer. The vegetation suitable for grazing includes Idaho fescue, prairie junegrass, and California brome. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

This unit is poorly suited to range seeding. The main limitations are the slope, droughtiness, and the clayey surface layer. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The slope limits access by livestock and results in overgrazing of the less sloping areas. Constructing trails or walkways allows livestock to graze in areas where access is limited.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of stones on the surface and the slope.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope.

The vegetative site is Droughty North, 18- to 35-inch precipitation zone.

82G—Heppsie-McMullin complex, 35 to 70 percent south slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 170 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Heppsie soil and 20 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop; Carney and Medco soils on concave slopes and on the less sloping parts of the landscape; Skookum and Tablerock soils; and, on ridges and convex slopes, soils that are similar to the Heppsie soil but have bedrock within a depth of 20 inches. Also included are small areas of Heppsie soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 20 percent of the total acreage.

The Heppsie soil is moderately deep and well drained. It formed in colluvium derived dominantly from tuff, breccia, and andesite. Typically, the surface layer is very dark brown and very dark grayish brown clay about 15 inches thick. The subsoil is dark brown gravelly clay about 9 inches thick. Weathered bedrock is at a depth of about 24 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Heppsie soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are erosion, compaction, the slope, and droughtiness. The McMullin soil also is limited by the depth to bedrock and the Heppsie soil by the clayey surface layer. The vegetation suitable for grazing includes Idaho fescue, prairie junegrass, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of stones on the surface and the slope.

This unit is poorly suited to range seeding. The main limitations are the slope, droughtiness, the depth to bedrock in the McMullin soil, and the clayey surface layer of the Heppsie soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The slope limits access by livestock and results in overgrazing of the less sloping areas. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope of both soils and the depth to bedrock in the McMullin soil.

The vegetative site in areas of the Heppsie soil is Loamy Hills, 20- to 35-inch precipitation zone, and the one in areas of the McMullin soil is Shallow Mountain Slopes, 22- to 30-inch precipitation zone.

83E—Hobit loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 5,000 to 6,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark brown loam about 18 inches thick. The subsoil also is very dark brown loam. It is about 8 inches thick. The substratum is dark yellowish brown gravelly clay loam about 9 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Tatouche soils, Bybee soils on concave slopes and on the less sloping parts of the landscape, soils that are similar to the Hobit soil but have bedrock at a depth of less than 20 or more than 40 inches or have more than 35 percent rock fragments, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Hobit soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Hobit soil. Available water capacity is about 7 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar, and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, common snowberry, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 70. The yield at culmination of the mean annual increment is 11,410 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and white fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

83G—Hobit loam, 35 to 60 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 5,000 to 6,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark brown loam about 18 inches thick. The subsoil also is very dark brown loam. It is about 8 inches thick. The substratum is dark yellowish brown gravelly clay loam about 9 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Tatouche soils, Woodseye soils and Rock outcrop on ridges and convex slopes, soils that are similar to the Hobit soil but have bedrock at a depth of less than 20 or more than 40 inches or have more than 35 percent rock fragments, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Hobit soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Hobit soil. Available water capacity is about 7 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar, and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, common snowberry, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 70. The yield at culmination of the mean annual increment is 11,410 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and white fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred

forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

84E—Hobit loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 5,000 to 6,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark brown loam about 18 inches thick. The subsoil also is very dark brown loam. It is about 8 inches thick. The substratum is dark yellowish brown gravelly clay loam about 9 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Tatouche soils, Bybee soils on concave slopes and on the less sloping parts of the landscape, soils that are similar to the Hobit soil but have bedrock at a depth of less than 20 or more than 40 inches, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Hobit soil but have more than 35 percent rock fragments. Also included are small areas of Hobit soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Hobit soil. Available water capacity is about 7 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and Douglas fir. Other species that grow on this unit include incense cedar. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 50-year site curve, the mean site index for white fir is 65. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

84G—Hobit loam, 35 to 60 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 5,000 to 6,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark brown loam about 18 inches thick. The subsoil also is very dark brown loam. It is about 8 inches thick. The substratum is dark yellowish brown gravelly clay loam about 9 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Tatouche soils, Woodseye soils and Rock outcrop on ridges and convex slopes, soils that are similar to the Hobit soil but have bedrock at a depth of less than 20 or more than 40 inches or have more than 35 percent rock fragments, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Hobit soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Hobit soil. Available water capacity is about 7 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and Douglas fir. Other species that grow on this unit include incense cedar. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 50-year site curve, the mean site index for white fir is 65. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris

can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

85A—Hoxie silt loam, 0 to 1 percent slopes. This very deep, poorly drained soil is in basins. It formed in lacustrine sediment derived dominantly from volcanic ash. Elevation is 4,300 to 5,000 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is black silt loam about 10 inches thick. The next 4 inches also is black silt loam. The upper 14 inches of the subsoil is grayish brown silt loam. The lower 16 inches is grayish brown very fine sandy loam and silt loam. The substratum to a depth of 65 inches is grayish brown silt loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of Kanutchan soils; very poorly drained, organic soils; and soils that are similar to the Hoxie soil but have a subsoil of clay. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Hoxie soil. Available water capacity is about 13 inches. The effective rooting depth is limited by the water table, which is within a depth of 3 feet from March through June. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for pasture and wildlife habitat. The main limitations affecting livestock grazing are the seasonal wetness, a short growing season, and compaction. The wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill.

If the pasture is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

Tufted hairgrass is the native plant preferred for livestock grazing; however, this unit can be renovated and forage production increased by seeding other suitable grasses. The plants selected for seeding should be those that are tolerant of a cold climate and wetness. Border and contour flood irrigation systems are suitable. Land leveling helps to ensure a uniform application of water. Fertilizer is needed to ensure the optimum growth of grasses. Grasses respond to nitrogen.

The vegetative site is Wet Meadow.

86C—Hukill gravelly loam, 1 to 12 percent slopes. This deep, well drained soil is on plateaus. It formed in residuum and colluvium derived from andesite.

Elevation is 2,000 to 3,000 feet. The mean annual precipitation is 30 to 45 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown gravelly loam about 2 inches thick. The next layer is dark reddish brown gravelly clay loam about 4 inches thick. The upper 5 inches of the subsoil also is dark reddish brown gravelly clay loam. The lower 31 inches is dark reddish brown gravelly clay. Weathered bedrock is at a depth of about 42 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Freezener soils, Terrabella soils near drainageways and on concave slopes, Geppert soils on convex slopes and on the more sloping parts of the landscape, and soils that are similar to the Hukill soil but have bedrock within a depth of 40 inches. Also included are small areas of Hukill soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Hukill soil. Available water capacity is about 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include sugar pine, ponderosa pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are compaction, erosion, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

87F—Jayar very gravelly loam, 12 to 45 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 3,600 to 5,300 feet. The mean annual precipitation is 40 to 60 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of

needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown very gravelly loam about 5 inches thick. The next layer is dark brown very gravelly loam about 6 inches thick. The subsoil also is dark brown very gravelly loam. It is about 13 inches thick. Bedrock is at a depth of about 24 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Woodseye soils and Rock outcrop on ridges and convex slopes and small areas of soils that are similar to the Jayar soil but are influenced by serpentine, have less than 35 percent rock fragments, or have bedrock at a depth of more than 40 inches. Also included are small areas of Jayar soils that have slopes of less than 12 or more than 45 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Jayar soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and whitevein shinleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts on this unit expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Mixed Fir-Oceanspray Forest.

87G—Jayar very gravelly loam, 45 to 70 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 3,600 to 5,300 feet. The mean annual precipitation is 40 to 60 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown very gravelly loam about 5 inches thick. The next layer is dark brown very gravelly loam about 6 inches thick. The subsoil also is dark brown very gravelly loam. It is about 13 inches thick. Bedrock is at a depth of about 24 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Woodseye soils and Rock outcrop on ridges and convex slopes and soils that are similar to the Jayar soil but are influenced by serpentine, have less than 35 percent

rock fragments, or have bedrock at a depth of more than 40 inches. Also included are small areas of Jayar soils that have slopes of less than 45 or more than 70 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Jayar soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and whitevein shinleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are the slope, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Mixed Fir-Oceanspray Forest.

88F—Jayar very gravelly loam, 12 to 45 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 3,600 to 5,300 feet. The mean annual precipitation is 40 to 60 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown very gravelly loam about 5 inches thick. The next layer is dark brown very gravelly loam about 6 inches thick. The subsoil also is dark brown very gravelly loam. It is about 13 inches thick. Bedrock is at a depth of about 24 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Woodseye soils and Rock outcrop on ridges and convex slopes and small areas of soils that are similar to the Jayar soil but are influenced by serpentine, have less than 35 percent rock fragments, or have bedrock at a depth of more than 40 inches. Also included are small areas of Jayar soils that have slopes of less than 12 or more than 45 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Jayar soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory

vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts on this unit expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Mixed Fir-Serviceberry Forest.

89E—Jayar Variant very gravelly loam, 5 to 35 percent slopes. This moderately deep, well drained soil is on ridges and hillslopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 4,700 to 5,300 feet. The mean annual precipitation is 50 to 60 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown and dark brown very gravelly loam about 8 inches thick. The subsoil is dark yellowish brown very cobbly loam about 16 inches thick. Bedrock is at a depth of about 24 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Woodseye soils and Rock outcrop on convex slopes and small areas of soils that are similar to the Jayar Variant soil but are influenced by serpentine, have less than 35 percent rock fragments, or have bedrock at a depth of more than 40 inches. Also included are small areas of Jayar Variant soils that have slopes of less than 5 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Jayar Variant soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of white fir and noble fir. Other species that grow on this unit include incense cedar and Douglas fir. The understory vegetation includes sierra chinkapin, currant, and pinemat manzanita.

On the basis of a 50-year site curve, the mean site index for white fir is 50. The yield at culmination of the mean annual increment is 6,370 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 58,200 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used

in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Seedling mortality is higher on ridgetops, which are more exposed to cold winds than other parts of the landscape. Proper timber harvesting methods can reduce the effect of frost on regeneration.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Noble Fir-Bush Chinkapin Forest.

90E—Josephine-Pollard complex, 12 to 35 percent north slopes. This map unit is on hillslopes and alluvial fans. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Josephine soil and 40 percent Pollard soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Goolaway, Siskiyou, Speaker, and Wolfpeak soils; Abegg soils on alluvial fans and along drainageways; Beekman soils on the more sloping parts of the landscape and on convex slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Josephine and Pollard soils but have more than 35 percent rock fragments. Also included are small areas of Josephine and Pollard soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Josephine soil is deep and well drained. It formed in colluvium and residuum derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 15 inches thick. The subsoil is dark reddish brown and reddish brown gravelly clay loam about 40 inches thick. Weathered bedrock is at a depth of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Permeability is moderately slow in the Josephine soil. Available water capacity is about 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Pollard soil is very deep and well drained. It formed in alluvium and colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark brown loam about 11 inches thick. The upper 25 inches of the subsoil is dark reddish brown clay loam. The lower 25 inches is yellowish red and brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam or gravelly loam.

Permeability is slow in the Pollard soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and golden chinkapin. The understory vegetation includes creambush oceanspray,

cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on both the Josephine and Pollard soils. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are erosion, compaction, slumping, and plant competition. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

The Pollard soil is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Chinkapin Forest.

91E—Josephine-Pollard complex, 12 to 35 percent south slopes. This map unit is on hillslopes and alluvial fans. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Josephine soil and 30 percent Pollard soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Abegg soils on alluvial fans and near drainageways; Beekman soils on the more sloping parts of the landscape and on convex slopes; poorly drained soils near drainageways and on concave slopes; Dubakella, Goolaway, Speaker, and Wolfpeak soils; and soils that are similar to the Josephine and Pollard soils but have more than 35 percent rock fragments. Also included are small areas of Josephine and Pollard soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Josephine soil is deep and well drained. It formed in colluvium and residuum derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 15 inches thick. The subsoil is dark reddish brown and reddish brown gravelly clay loam about 40 inches thick. Weathered bedrock is at a depth of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Permeability is moderately slow in the Josephine soil. Available water capacity is about 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Pollard soil is very deep and well drained. It formed in alluvium and colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark brown loam about 11 inches thick. The upper 25 inches of the subsoil is dark reddish brown clay loam. The lower 25 inches is yellowish red and brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam or gravelly loam.

Permeability is slow in the Pollard soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include sugar pine and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Josephine soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged

stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Pollard soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115 on both the Josephine and Pollard soils. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,870 board feet per acre (Scribner rule) at 110 years.

The main limitations affecting timber production are erosion, compaction, slumping, seedling mortality, and plant competition. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

The Pollard soil is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Clearcutting increases the hazard of slumping on this unit. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Black Oak Forest.

92E—Josephine-Speaker complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Josephine soil and 25 percent Speaker soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Goolaway, and Wolfpeak soils; Abegg soils on alluvial fans and near drainageways; Pollard soils on concave slopes; Beekman soils on the more sloping parts of the landscape and on convex slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Josephine and Speaker soils but have more than 35 percent rock fragments. Also included are small areas of Josephine and Speaker soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Josephine soil is deep and well drained. It formed in colluvium and residuum derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 15 inches thick. The subsoil is dark reddish brown and reddish brown gravelly clay loam about 40 inches thick. Weathered bedrock is at a depth of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Permeability is moderately slow in the Josephine soil. Available water capacity is about 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Speaker soil is moderately deep and well drained. It formed in colluvium derived dominantly from

metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown loam about 13 inches thick. The upper 10 inches of the subsoil also is dark brown loam. The lower 12 inches is brown gravelly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability is moderately slow in the Speaker soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and golden chinkapin. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Josephine soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Speaker soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Chinkapin Forest.

92F—Josephine-Speaker complex, 35 to 55 percent north slopes. This map unit is on hillslopes. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Josephine soil and 30 percent Speaker soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Goolaway, Pearsoll, and Siskiyou soils; Pollard soils on the less sloping parts of the landscape and on concave slopes; Beekman and McMullin soils on the more sloping parts of the landscape; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Josephine and Speaker soils but have more than 35 percent rock fragments. Also included are small areas of Josephine and Speaker soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 15 percent of the total acreage.

The Josephine soil is deep and well drained. It formed in colluvium and residuum derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 15 inches thick. The subsoil is dark reddish brown and reddish brown gravelly clay loam about 40 inches thick. Weathered bedrock is at a depth of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Permeability is moderately slow in the Josephine soil. Available water capacity is about 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

The Speaker soil is moderately deep and well

drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown loam about 13 inches thick. The upper 10 inches of the subsoil also is dark brown loam. The lower 12 inches is brown gravelly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability is moderately slow in the Speaker soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and golden chinkapin. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Josephine soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Speaker soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Chinkapin Forest.

93E—Josephine-Speaker complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Josephine soil and 35 percent Speaker soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Goolaway, and Wolfpeak soils; Abegg soils on alluvial fans and near drainageways; Pollard soils on concave slopes; Beekman soils on the more sloping parts of the landscape and on convex slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Josephine and Speaker soils but have more than 35 percent rock fragments. Also included are small areas of Josephine and Speaker soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Josephine soil is deep and well drained. It formed in colluvium and residuum derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 15 inches thick. The subsoil is dark reddish brown and reddish brown gravelly clay loam about 40 inches thick. Weathered bedrock is at a depth

of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Permeability is moderately slow in the Josephine soil. Available water capacity is about 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Speaker soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown loam about 13 inches thick. The upper 10 inches of the subsoil also is dark brown loam. The lower 12 inches is brown gravelly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability is moderately slow in the Speaker soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include sugar pine and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Josephine soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115 on the Josephine soil. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,870 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115 on the Speaker soil. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 105 on the Speaker soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Black Oak Forest.

94G—Kanid-Atring very gravelly loams, 50 to 80 percent north slopes. This map unit is on hillslopes. Elevation is 2,400 to 4,100 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 47 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Kanid soil and 20 percent Atring soil. The components of this unit occur

as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Gravecreek, Norling, Pearsoll, and Steinmetz soils; Rock outcrop; Acker soils on the less sloping parts of the landscape; and, on ridges and convex slopes, soils that are similar to the Atring soil but have bedrock within a depth of 20 inches. Also included are small areas of Kanid and Atring soils that have slopes of less than 50 or more than 80 percent. Included areas make up about 20 percent of the total acreage.

The Kanid soil is deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown and brown very gravelly loam about 18 inches thick. The subsoil is yellowish brown and light olive brown very gravelly clay loam about 29 inches thick. Weathered bedrock is at a depth of about 47 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Kanid soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

The Atring soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark brown very gravelly loam about 7 inches thick. The subsoil is brown and yellowish brown very gravelly loam about 33 inches thick. Weathered bedrock is at a depth of about 40 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Atring soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, golden chinkapin, and western hemlock. The understory vegetation includes salal, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on both the Kanid and Atring soils. The yield at culmination of the mean annual increment is 7,800 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are the slope, erosion, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soils also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Mixed Fir-Salal (rhododendron) Forest.

95G—Kanid-Atring very gravelly loams, 50 to 80 percent south slopes. This map unit is on hillslopes. Elevation is 2,400 to 4,100 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 47 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Kanid soil and 20 percent Atring soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Gravecreek, Norling, Pearsoll, and Steinmetz soils; Rock outcrop; Acker soils on the less sloping parts of the landscape; and, on ridges and convex slopes, soils that are similar to the Atring soil but have bedrock within a depth of 20 inches. Also included are small areas of Kanid and Atring soils that have slopes of less than 50 or more than 80 percent. Included areas make up about 20 percent of the total acreage.

The Kanid soil is deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown and brown very gravelly loam about 18 inches thick. The subsoil is yellowish brown and light olive brown very gravelly clay loam about 29 inches thick. Weathered bedrock is at a depth of about 47 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Kanid soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

The Atring soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark brown very gravelly loam about 7 inches thick. The subsoil is brown and yellowish brown very gravelly loam about 33 inches thick. Weathered bedrock is at a depth of about 40 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Atring soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, golden chinkapin, and Pacific madrone. The understory vegetation includes Whipplevine, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on both the Kanid and Atring soils. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around

seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Madrone-Chinkapin Forest.

96B—Kanutchan clay, 1 to 8 percent slopes. This deep, somewhat poorly drained soil is in basins. It formed in alluvium and colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 25 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is black clay about 20 inches thick. The subsoil is black and very dark gray clay about 26 inches thick. Bedrock is at a depth of about 46 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Bybee, Farva, Pinehurst, Sibannac, and Tatouche soils. Also included are small areas of soils that are similar to the Kanutchan soil but have bedrock at a depth of less than 40 or more than 60 inches and small areas of Kanutchan soils that have slopes of more than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is very slow in the Kanutchan soil. Available water capacity is about 7 inches. The effective rooting depth is limited by the water table, which is within a depth of 1.5 feet from December through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for livestock grazing and wildlife habitat. It is well suited to permanent pasture. The main limitations affecting livestock grazing are the seasonal wetness, compaction, the high content of clay, and a slow rate of water intake. The wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer.

If the pasture is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

Tufted hairgrass is the native plant preferred for livestock grazing; however, this unit can be renovated and forage production increased by seeding other suitable grasses. The plants selected for seeding should be those that are tolerant of wetness. Border and contour flood irrigation systems are suitable. Because of the very slow permeability, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land leveling helps to ensure a uniform application of water. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The vegetative site is Wet Meadow.

97A—Kerby loam, 0 to 3 percent slopes. This very deep, well drained soil is on stream terraces. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 2,000 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The vegetation in areas that have not been cultivated is mainly grasses and forbs.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsoil is dark brown loam about 47 inches thick. The substratum to a depth of 60 inches is dark brown very gravelly sandy loam.

Included in this unit are small areas of Gregory and Kubli soils on concave slopes, Central Point and Medford soils, and soils that are similar to the Kerby soil but have very gravelly layers within a depth of 40 inches. Also included are small areas of Kerby soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Kerby soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated crops, such as grass seed, onions, alfalfa, and tree fruit. Other crops include strawberries, small grain, and sugar beet seed. Some areas are used for homesite development or pasture.

This unit is well suited to irrigated crops. It has few limitations. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the

crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. It has few limitations. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

98A—Kerby loam, wet, 0 to 3 percent slopes. This very deep, moderately well drained soil is on stream terraces. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 1,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown and dark yellowish brown loam about 15 inches thick. The subsoil is brown and dark yellowish brown clay loam about 40 inches thick. The substratum to a depth of 60 inches is dark yellowish brown loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Central Point, Kerby, and Medford soils; Gregory soils on concave slopes; and Brader, Debenger, and Langellain soils on convex slopes. Also included are small areas of Kerby soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Kerby soil. Available water capacity is about 10 inches. The effective rooting depth is limited by the water table, which is at a depth of 1.5 to 2.5 feet from December through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for irrigated small grain and hay and pasture.

This unit is suited to irrigated crops. It is limited mainly by wetness in winter and spring. Crops that require good drainage can be grown if a properly designed tile drainage system is installed. Tile drainage can lower the water table if a suitable outlet is available. Land smoothing and open ditches can reduce surface wetness.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

The main limitations in the areas used for hay and pasture are wetness in winter and spring and compaction. The wetness limits the choice of suitable

forage plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

99A—Klamath silt loam, 0 to 1 percent slopes. This very deep, poorly drained soil is on flood plains. It formed in alluvium derived dominantly from volcanic ash, andesite, and basalt. Elevation is 3,900 to 5,400 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 42 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is black silt loam about 3 inches thick. The next layer is black clay about 8 inches thick. The subsoil is very dark gray and dark gray silty clay about 26 inches thick. The substratum to a depth of 62 inches is gray silty clay loam and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Pokegema and Woodcock soils; very stony, shallow soils; and very poorly drained, organic soils. Also included are small areas of soils that are similar to the Klamath soil but are well drained or are not flooded and small areas of Klamath soils that have slopes of more than 1 percent. Included areas make up about 10 percent of the total acreage.

Permeability is slow in the Klamath soil. Available water capacity is about 13 inches. The effective rooting depth is limited by the water table, which is within a depth of 3 feet from March through June. Runoff is slow, and the hazard of water erosion is slight. This soil is frequently flooded for long periods from March through May.

This unit is used for livestock grazing and wildlife habitat. It is suited to pasture. The main limitations affecting livestock grazing are the flooding, the seasonal wetness, compaction, and a short growing season. The wetness limits the choice of suitable forage plants and the period of grazing and increases the risk of winterkill.

If the pasture is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Tufted hairgrass is the native plant preferred for livestock grazing; however, this unit can be renovated and forage production increased by seeding other suitable grasses. The plants selected for seeding should be those that are tolerant of wetness.

The vegetative site is Wet Meadow.

100A—Kubli loam, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on stream terraces. It formed in alluvium derived dominantly from granitic rock and underlain by clayey sediment. Elevation is 1,000 to 2,300 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The vegetation in areas that have not been cultivated is mainly grasses and forbs.

Typically, the surface layer is very dark brown loam about 9 inches thick. The next layer is very dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown loam about 16 inches thick. The upper 16 inches of the substratum is brown clay. The lower part to a depth of 60 inches is brown clay loam.

Included in this unit are small areas of Medford soils, Barron and Central Point soils on the higher terraces and alluvial fans, and Gregory soils and poorly drained or very poorly drained, loamy soils near drainageways and on concave slopes. Also included are small areas of Kubli soils that have slopes of more than 3 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate to a depth of 31 inches in the Kubli soil and very slow below that depth. Available water capacity is about 10 inches. The effective rooting depth is limited by the dense, clayey substratum, which is at a depth of 25 to 35 inches. Runoff is slow, and the hazard of water erosion is slight. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 3.0 feet from November through April.

This unit is used mainly for homesite development, pasture, or irrigated crops, such as alfalfa hay, small

grain, and grass-legume hay. It also is used for tree fruit, sugar beet seed, and corn for silage.

This unit is suited to irrigated crops. It is limited mainly by wetness in winter and spring and the very slow permeability. Crops that require good drainage can be grown if a properly designed tile drainage system is installed. Tile drainage can lower the water table if collection laterals are closely spaced and a suitable outlet is available. Land smoothing and open ditches can reduce the surface wetness.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the wetness, the very slow permeability in the substratum, a high shrink-swell potential, and low strength.

The very slow permeability and the perched water table increase the possibility that septic tank absorption fields will fail. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Because the seasonal high water table is perched above the layer of clay, a drainage system is needed if buildings with basements and crawl spaces are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

100B—Kubli loam, 3 to 7 percent slopes. This very deep, somewhat poorly drained soil is on terraces. It formed in alluvium derived dominantly from granitic rock and underlain by clayey sediment. Elevation is 1,000 to 2,300 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The vegetation in areas that have not been cultivated is mainly grasses and forbs.

Typically, the surface layer is very dark brown loam about 9 inches thick. The next layer is very dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown loam about 16 inches thick. The upper 16 inches of the substratum is brown clay. The lower part to a depth of 60 inches is brown clay loam.

Included in this unit are small areas of Medford soils, Barron and Central Point soils on the higher terraces and alluvial fans, and Gregory soils and poorly drained or very poorly drained, loamy soils near drainageways and on concave slopes. Also included are small areas of Kubli soils that have slopes of less than 3 or more than 7 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate to a depth of 31 inches in the Kubli soil and very slow below that depth. Available water capacity is about 10 inches. The effective rooting depth is limited by the dense, clayey substratum, which

is at a depth of 25 to 35 inches. Runoff is slow, and the hazard of water erosion is slight. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 3.0 feet from November through April.

This unit is used mainly for homesite development or for hay and pasture. It also is used for tree fruit.

This unit is suited to irrigated crops. It is limited mainly by wetness in winter and spring, the very slow permeability, and the slope. Crops that require good drainage can be grown if a properly designed tile drainage system is installed. Tile drainage can lower the water table if collection laterals are closely spaced and a suitable outlet is available. Open ditches and land smoothing on the less sloping parts of the landscape can reduce surface wetness.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the wetness, the very slow permeability, a high shrink-swell potential, and low strength.

The very slow permeability and the seasonal high water table increase the possibility that septic tank absorption fields will fail. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Because the seasonal high water table is perched above the layer of clay, a drainage system is needed on sites for buildings with basements and crawl spaces. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

101E—Langellain loam, 15 to 40 percent north slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in colluvium and alluvium derived dominantly from sedimentary rock. Elevation is 1,300 to 3,200 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 130 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of grasses, twigs, and leaves about ½ inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The next layer is dark brown loam about 4 inches thick. The upper 11 inches of the subsoil is strong brown loam. The lower 17 inches is brown and yellowish brown clay. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Debenger soils, Carney and Selmac soils on concave slopes, Brader soils on ridges and convex slopes, Ruch and Manita soils on foot slopes, and soils that are similar to

the Langellain soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Langellain soils that have slopes of less than 15 or more than 40 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate to a depth of 21 inches in the Langellain soil and very slow below that depth. Available water capacity is about 4 inches. The effective rooting depth is limited by the layer of dense clay in the subsoil. This layer is at a depth of 12 to 28 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 2.0 feet from December through May.

This unit is used for livestock grazing, timber production, and wildlife habitat.

The main limitations affecting livestock grazing are compaction, erosion, and seasonal wetness. The vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Because this soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar and Pacific madrone. The understory vegetation includes oceanspray, tall Oregon grape, and poison oak.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are erosion, compaction, slumping, the seasonal wetness, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The perched seasonal high water table limits the use of equipment to dry periods. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

This unit is subject to severe slumping. Road failure and landslides are likely to occur after road construction. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees

unharvested provides shade for seedlings. The seasonal wetness increases the seedling mortality rate. Also, seedlings planted in the less fertile clayey subsoil grow poorly.

The vegetative site is Douglas Fir Forest.

102B—Langellain-Brader loams, 1 to 7 percent slopes. This map unit is on knolls and ridges. Elevation is 1,300 to 3,200 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 130 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Langellain soil and 20 percent Brader soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Debenger and Ruch soils, Carney and Selmac soils on concave slopes, Coker and Gregory soils on concave slopes and near drainageways, Kerby and Medford soils on terraces, and soils that are similar to the Brader soil but have bedrock within a depth of 12 inches. Also included are small areas of Langellain and Brader soils that have slopes of more than 7 percent. Included areas make up about 25 percent of the total acreage.

The Langellain soil is moderately deep and moderately well drained. It formed in colluvium and alluvium derived dominantly from sedimentary rock. Typically, the surface is covered with a layer of grasses, twigs, and leaves about ½ inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The next layer is dark brown loam about 4 inches thick. The upper 11 inches of the subsoil is strong brown loam. The lower 17 inches is brown and yellowish brown clay. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate to a depth of 21 inches in the Langellain soil and very slow below that depth. Available water capacity is about 4 inches. The effective rooting depth is limited by the layer of dense clay in the subsoil. This layer is at a depth of 12 to 28 inches. Runoff is slow, and the hazard of water erosion is slight. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 2.0 feet from December through May.

The Brader soil is shallow and well drained. It formed in colluvium derived dominantly from sedimentary rock. Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil is dark reddish brown loam about 7 inches thick. Weathered bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the Brader soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used for hay and pasture, livestock grazing, and homesite development.

This unit is suited to irrigated hay and pasture. It is limited mainly by droughtiness; the depth to bedrock in the Brader soil; and, in the Langellain soil, the very slow permeability in the subsoil and wetness in winter and spring.

In summer, irrigation is needed for the maximum production of hay and pasture. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable in the less sloping areas. For the efficient application and removal of surface irrigation water, land leveling is needed. If cuts are too deep, however, the bedrock or the clayey subsoil may be exposed. To prevent overirrigation and excessive erosion or development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

The ability of tile drains to remove subsurface water is limited because of the very slow permeability in the subsoil of the Langellain soil and the lack of suitable outlets. Land smoothing and open ditches can reduce surface wetness.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting livestock grazing are compaction and droughtiness. The Langellain soil also is limited by wetness in winter and spring and the Brader soil by the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

The Langellain soil remains wet for long periods in spring; therefore, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Range seeding is suitable if the site is in poor condition. The main limitations affecting seeding are the wetness of the Langellain soil in winter and spring, the depth to bedrock in the Brader soil, and droughtiness in both soils. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The main limitations affecting homesite development are the wetness, a high shrink-swell potential, the very slow permeability, and the depth to bedrock.

This unit is poorly suited to standard systems of waste disposal because of the wetness, the very slow permeability, and the depth to bedrock. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Because the seasonal high water table is perched above the layer of clay, a drainage system is needed on sites for buildings with basements and crawl spaces. The wetness can be reduced by installing drainage tile around footings. If buildings are constructed on the Langellain soil, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the Langellain soil to support a load.

Cuts needed to provide essentially level building sites can expose bedrock. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

102D—Langellain-Brader loams, 7 to 15 percent slopes. This map unit is on knolls and ridges. Elevation is 1,300 to 3,200 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 130 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Langellain soil and 25 percent Brader soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Carney and Selmac soils on concave slopes, Coker and Gregory soils near drainageways, Medford soils on terraces, Debenger and Ruch soils, and soils that are similar to the Brader soil but have bedrock within a depth of 12 inches. Also included are small areas of Langellain and Brader soils that have slopes of less than 7 or more than 15 percent. Included areas make up about 20 percent of the total acreage.

The Langellain soil is moderately deep and moderately well drained. It formed in colluvium and alluvium derived dominantly from sedimentary rock. Typically, the surface is covered with a layer of grasses, twigs, and leaves about ½ inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The next layer is dark brown loam about 4 inches thick. The upper 11 inches of the subsoil is strong brown loam. The lower 17 inches is brown and yellowish brown clay. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate to a depth of 21 inches in the Langellain soil and very slow below that depth. Available water capacity is about 4 inches. The effective rooting depth is limited by the layer of dense clay in the subsoil. This layer is at a depth of 12 to 28 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 2.0 feet from December through May.

The Brader soil is shallow and well drained. It formed in colluvium derived dominantly from sedimentary rock. Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil is dark reddish brown loam about 7 inches thick. Weathered bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the Brader soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for hay and pasture, livestock grazing, and homesite development.

This unit is suited to irrigated hay and pasture. It is

limited mainly by droughtiness, the slope, and the depth to bedrock in the Brader soil. The Langellain soil also is limited by the very slow permeability in the subsoil and wetness in winter and spring.

In summer, irrigation is needed for the maximum production of hay and pasture. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion or development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

The ability of tile drains to remove subsurface water is limited because of the slope, the very slow permeability in the subsoil of the Langellain soil, and the lack of suitable outlets. Wetness can be reduced by interceptor drains.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting livestock grazing are compaction, erosion, and droughtiness. The Langellain soil also is limited by wetness in winter and spring and the Brader soil by the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

The Langellain soil remains wet for long periods in spring. As a result, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitations are the wetness of the Langellain soil in winter and spring, the depth to bedrock in the Brader soil, and droughtiness in both soils. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The main limitations affecting homesite development are the wetness, a high shrink-swell potential, the depth to bedrock, and the very slow permeability in the Langellain soil.

This unit is poorly suited to standard systems of waste disposal because of the wetness, the very slow permeability, and the depth to bedrock. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Because the seasonal high water table is perched above the layer of clay, a drainage system is needed on sites for buildings with basements and crawl spaces. The wetness can be reduced by installing drainage tile around footings. If buildings are constructed on the Langellain soil, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the Langellain soil to support a load.

Cuts needed to provide essentially level building sites can expose bedrock. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

103E—Langellain-Brader loams, 15 to 40 percent south slopes. This map unit is on hillslopes. Elevation is 1,300 to 3,200 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 130 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Langellain soil and 30 percent Brader soil. The components of this unit occur as areas so intricately intermingled that mapping them

separately was not practical at the scale used.

Included in this unit are small areas of Debenger soils, Carney and Selmac soils on concave slopes, Ruch and Manita soils on foot slopes, and soils that are similar to the Brader soil but have more than 35 percent rock fragments or have bedrock within a depth of 12 inches. Also included are small areas of Langellain and Brader soils that have slopes of less than 15 or more than 40 percent. Included areas make up about 20 percent of the total acreage.

The Langellain soil is moderately deep and moderately well drained. It formed in colluvium and alluvium derived dominantly from sedimentary rock. Typically, the surface is covered with a layer of grasses, twigs, and leaves about ½ inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The next layer is dark brown loam about 4 inches thick. The upper 11 inches of the subsoil is strong brown loam. The lower 17 inches is brown and yellowish brown clay. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate to a depth of 21 inches in the Langellain soil and very slow below that depth. Available water capacity is about 4 inches. The effective rooting depth is limited by the layer of dense clay in the subsoil. This layer is at a depth of 12 to 28 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 2.0 feet from December through May.

The Brader soil is shallow and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil is dark reddish brown loam about 7 inches thick. Weathered bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the Brader soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction, erosion, droughtiness, and the slope. The Langellain soil also is limited by wetness in winter and spring and the Brader soil by the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

The Langellain soil remains wet for long periods in spring. As a result, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Range seeding is suitable if the site is in poor condition. The main limitations are the depth to bedrock in the Brader soil, the wetness of the Langellain soil in winter and spring, and droughtiness and the slope in areas of both soils. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment and access by livestock are limited by the slope. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

104E—Lettia sandy loam, 12 to 35 percent north slopes. This deep, well drained soil is on hillslopes. It formed in colluvium and residuum derived from granitic rock. Elevation is 1,800 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark brown sandy loam about 3 inches thick. The next layer is brown and reddish brown loam about 11 inches thick. The upper 12 inches of the subsoil is red clay loam. The lower 29 inches is red loam. Weathered bedrock is at a depth of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Included in this unit are small areas of Acker, Dumont, Goolaway, and Musty soils; Steinmetz soils on the more sloping parts of the landscape; poorly drained soils near drainageways and on concave slopes; soils that are similar to the Lettia soil but have bedrock at a depth of more than 60 inches; and, on ridges and convex slopes, soils that are similar to Steinmetz and Lettia soils but have bedrock within a depth of 40 inches. Also included are small areas of Lettia soils that have slopes of less than 12 or more than 35 percent.

Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Lettia soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, western hemlock, and Pacific madrone. The understory vegetation includes golden chinkapin, salal, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 105.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Mixed Fir-Salal (rhododendron) Forest.

105E—Lettia sandy loam, 12 to 35 percent south slopes. This deep, well drained soil is on hillslopes. It formed in colluvium and residuum derived from granitic rock. Elevation is 1,800 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark brown sandy loam about 3 inches thick. The next layer is brown and reddish brown loam about 11 inches thick. The upper 12 inches of the subsoil is red clay loam. The lower 29 inches is red loam. Weathered bedrock is at a depth of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Included in this unit are small areas of Acker, Dumont, Goolaway, and Musty soils; Steinmetz soils on the more sloping parts of the landscape; poorly drained soils near drainageways and on concave slopes; soils that are similar to the Lettia soil but have bedrock at a depth of more than 60 inches; and, on ridges and convex slopes, soils that are similar to the Lettia soil but have bedrock within a depth of 40 inches. Also included are small areas of Lettia soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Lettia soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory

vegetation includes golden chinkapin, Whipplevine, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Madrone-Chinkapin Forest.

106C—Lobert sandy loam, 0 to 12 percent slopes. This very deep, well drained soil is on stream terraces. It formed in alluvial and lacustrine sediment derived dominantly from tuff and volcanic ash. Elevation is 4,200 to 4,400 feet. The mean annual precipitation is 16 to 18 inches, the mean annual temperature is 43 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is dark reddish brown sandy loam about 20 inches thick. The upper 21 inches of the subsoil is dark reddish brown loam. The lower part to a depth of 60 inches is dark brown loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Kanutchan, Pokegema, and Woodcock soils and soils that are similar to the Lobert soil but have bedrock within a depth of 60 inches or are poorly drained. Also included are small areas of Lobert soils that have slopes of more than 12 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Lobert soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of ponderosa pine. The understory vegetation includes antelope bitterbrush, Pacific serviceberry, and Idaho fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 80. The yield at culmination of the mean annual increment is 2,670 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 33,750 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production are compaction, erosion, and seedling mortality. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by

using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting ponderosa pine seedlings.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and western needlegrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Deep Loamy, 16- to 20-inch precipitation zone.

107E—Lorella-Skookum complex, 15 to 35 percent slopes. This map unit is on hillslopes. Elevation is 3,800 to 4,800 feet. The mean annual precipitation is 18 to 20 inches, the mean annual temperature is 45 to 51 degrees F, and the average frost-free period is 100 to 120 days. The native vegetation is mainly grasses, shrubs, and forbs and a few scattered hardwoods and conifers.

This unit is about 55 percent Lorella soil and 25 percent Skookum soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Paragon soils, Rock outcrop on ridges and convex slopes, soils that are similar to the Lorella soil but have bedrock within a depth of 12 inches, and soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Lorella and Skookum soils that have slopes of less than 15 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Lorella soil is shallow and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown extremely stony loam about 5 inches thick. The subsoil is very dark brown and dark brown very cobbly clay loam about 12 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is slow in the Lorella soil. Available water capacity is about 1 inch. The effective rooting depth is 12 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Skookum soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction, erosion, the stones and cobbles on the surface, and droughtiness. The Lorella soil also is limited by the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the

more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. Because of the stones and cobbles on the surface and the included areas of Rock outcrop, the use of equipment is impractical.

This unit is poorly suited to range seeding. The main limitations are droughtiness, the stones and cobbles on the surface, and the depth to bedrock in the Lorella soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Droughty Slopes, 20- to 30-inch precipitation zone.

108B—Manita loam, 2 to 7 percent slopes. This deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 47 to 54 degrees F, and the average frost-free period is 100 to 170 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 8 inches thick. The upper 5 inches of the subsoil is dark reddish brown clay loam. The lower 45 inches is yellowish red clay loam. Weathered bedrock is at a depth of about 58 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly.

Included in this unit are small areas of Ruch soils, Darow and Vannoy soils on convex slopes, Selmac soils on concave slopes, Gregory and Medford soils near drainageways and on terraces, and soils that are similar to the Manita soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Manita soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Manita soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for irrigated crops, such as alfalfa hay, small grain, and tree fruit. Other crops include corn for silage and grass-legume hay. Some areas are used for timber production, pasture, or homesite development.

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to homesite development. The main limitations are the moderately slow permeability and the shrink-swell potential. The moderately slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites.

Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Pine-Douglas Fir-Fescue.

108D—Manita loam, 7 to 20 percent slopes. This deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 47 to 54 degrees F, and the average frost-free period is 100 to 170 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 8 inches thick. The upper 5 inches of the subsoil is dark reddish brown clay loam. The lower 45 inches is yellowish red clay loam. Weathered bedrock is at a depth of about 58 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly.

Included in this unit are small areas of Ruch soils, Darow and Vannoy soils on ridges and convex slopes, Selmac soils on concave slopes, Gregory and Medford soils near drainageways on terraces, and soils that are similar to the Manita soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Manita soils that have slopes of less than 7 or more than 20 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Manita soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used for irrigated crops, such as alfalfa hay, small grain, tree fruit, and grass-legume hay. It also is used for timber production, pasture, and homesite development.

This unit is suited to irrigated crops. It is limited mainly by the slope and the moderately slow permeability. In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface

crusting and compaction can be minimized by returning crop residue to the soil.

The hazard of erosion can be reduced if fall grain is seeded early, tillage is minimized, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grasses.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

The main limitations affecting homesite development are the moderately slow permeability, the shrink-swell potential, and the slope. The moderately slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Pine-Douglas Fir-Fescue.

108E—Manita loam, 20 to 35 percent slopes. This deep, well drained soil is on alluvial fans and hillslopes. It formed in alluvium and colluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 47 to 54 degrees F, and the average frost-free period is 100 to 170 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 8 inches thick. The upper 5 inches of the subsoil is dark reddish brown clay loam. The lower 45 inches is yellowish red clay loam. Weathered bedrock is at a depth of about 58 inches. The depth to bedrock ranges

from 40 to 60 inches. In some areas the surface layer is gravelly.

Included in this unit are small areas of Darow, Vannoy, and Voorhies soils on ridges and convex slopes, Selmac soils on concave slopes, poorly drained soils near drainageways and on concave slopes, Ruch soils on toe slopes, and soils that are similar to the Manita soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Manita soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Manita soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for hay and pasture, timber production, and homesite development.

The main limitations in the areas used for hay and pasture are the slope, erosion, and compaction. Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the slope, the moderately slow permeability, and the shrink-swell potential. The moderately slow permeability can be overcome by increasing the size of the absorption field. Because of the slope, the absorption lines should be installed on the contour.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

The slope limits the use of the steeper parts of the landscape for building site development because of the risk of erosion. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer result in a high seedling mortality rate, especially on south- and southwest-facing slopes. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in

summer and minimizes competition from undesirable understory plants.

The vegetative site is Pine-Douglas Fir-Fescue.

108F—Manita loam, 35 to 50 percent slopes. This deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 47 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 8 inches thick. The upper 5 inches of the subsoil is dark reddish brown clay loam. The lower 45 inches is yellowish red clay loam. Weathered bedrock is at a depth of about 58 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly or very gravelly.

Included in this unit are small areas of Vannoy and Voorhies soils, soils that are similar to the Manita soil but have bedrock at a depth of more than 60 inches, Ruch soils on toe slopes, Selmac soils on concave slopes, and McMullin soils on ridges and on convex slopes. Also included are small areas of Manita soils that have slopes of less than 35 or more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Manita soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper parts of the landscape can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer result in a high seedling mortality rate, especially on south- and southwest-facing slopes. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced on south- and southwest-facing slopes by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Pine-Douglas Fir-Fescue.

109E—Manita-Vannoy complex, 20 to 40 percent slopes. This map unit is on alluvial fans and hillslopes. Elevation is 1,000 to 4,000 feet. The mean annual

precipitation is 20 to 40 inches, the mean annual temperature is 47 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Manita soil and 35 percent Vannoy soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used. The Manita soil is commonly on the less sloping parts of the landscape.

Included in this unit are small areas of Darow and Voorhies soils on ridges and convex slopes, Selmac soils on concave slopes, poorly drained soils near drainageways, Ruch soils on toe slopes, and soils that are similar to the Manita soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Manita soils that have slopes of less than 20 or more than 40 percent. Included areas make up about 10 percent of the total acreage.

The Manita soil is deep and well drained. It formed in alluvium and colluvium derived dominantly from metamorphic rock. Typically, the surface layer is dark brown loam about 8 inches thick. The upper 5 inches of the subsoil is dark reddish brown clay loam. The lower 45 inches is yellowish red clay loam. Weathered bedrock is at a depth of about 58 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly.

Permeability is moderately slow in the Manita soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

The Vannoy soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about ¾ inch thick. The surface layer is dark brown silt loam about 4 inches thick. The next layer is reddish brown silt loam about 7 inches thick. The subsoil is yellowish red clay loam about 27 inches thick. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or very gravelly.

Permeability is moderately slow in the Vannoy soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used for hay and pasture, timber production, and homesite development.

The main limitations in the areas used for hay and pasture are the slope, erosion, and compaction. This unit is not suitable for irrigation because of the slope. Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the depth to bedrock in the Vannoy soil, the shrink-swell potential of the Manita soil, and the slope and moderately slow permeability of both soils. The moderately slow permeability can be overcome by increasing the size of the absorption field. Because of the slope, the absorption lines should be installed on the contour. The deeper and less sloping areas of the Vannoy soil may be suited to septic tank absorption fields. Onsite investigation is needed to locate such areas.

The slope limits the use of the steeper areas of this unit for building site development. Cuts needed to provide essentially level building sites can expose bedrock. If buildings are constructed on the Manita soil, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the Manita soil to support a load.

Erosion is a hazard on the steeper parts of the landscape. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105 on both the Manita and Vannoy soils. The yield at culmination of the mean

annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90 on the Vannoy soil. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are erosion, compaction, the slope, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

The Manita soil may be subject to slumping; therefore, road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer result in a high seedling mortality rate, especially on south- and southwest-facing slopes. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced on south- and southwest-facing slopes by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Pine-Douglas Fir-Fescue.

110E—McMullin gravelly loam, 3 to 35 percent slopes. This shallow, well drained soil is on hillslopes. It formed in colluvium derived dominantly from igneous and metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 180 days. The native vegetation is mainly grasses, shrubs, and forbs.

Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Included in this unit are small areas of McNull soils, Carney and Medco soils on concave slopes, Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McMullin soil but have more than 35 percent rock fragments or are less than 12 inches or more than 20 inches deep over bedrock. Also included are McMullin soils that have slopes of more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used for livestock grazing and wildlife habitat The main limitations affecting livestock grazing are compaction, erosion, droughtiness, and the depth to bedrock. The vegetation suitable for grazing includes bluebunch wheatgrass, Lemmon needlegrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing,

and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment is limited by the included areas of stony soils and Rock outcrop.

This unit is poorly suited to range seeding. The main limitations are the depth to bedrock, droughtiness, and the included areas of stony soils and Rock outcrop. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Loamy Shrub Scabland, 18- to 35-inch precipitation zone.

111G—McMullin-McNull gravelly loams, 35 to 60 percent south slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the McMullin soil is mainly grasses, shrubs, and forbs. That on the McNull soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent McMullin soil and 25 percent McNull soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Medco soils on concave slopes, Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches, soils that are similar to the McMullin soil but have bedrock at a depth of less than 12 or more than 20 inches, and soils that are similar to the McNull and McMullin soils but have more than 35 percent rock fragments. Also included are small areas of McNull and McMullin soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 15 percent of the total acreage.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The McNull soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for livestock grazing or wildlife habitat. The McNull soil also is used for timber production.

The main limitations affecting livestock grazing are the slope, erosion, and compaction. The McMullin soil also is limited by the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass on the McMullin soil and Idaho fescue, western fescue, and tall trisetum on the McNull soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Mechanical treatment is not practical because of the slope and the included areas of Rock outcrop and stony soils.

This unit is poorly suited to range seeding. The main limitations are the slope of both soils and the depth to bedrock in the McMullin soil.

The slope limits access by livestock. As a result, the less sloping areas tend to be overgrazed. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

Thinning, logging, and fire on the McNull soil reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment.

The McNull soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100 year site curve, the mean site index for Douglas fir is 95 on the McNull soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production on the McNull soil are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site in areas of the McMullin soil is Shallow Mountain Slopes, 22- to 30-inch precipitation zone, and the one in areas of the McNull soil is Pine-Douglas Fir-Fescue.

112F—McMullin-Medco complex, 12 to 50 percent slopes. This map unit is on hillslopes (fig. 9). Elevation is 1,300 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the McMullin soil is mainly grasses, shrubs, and forbs. That on the Medco soil is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent McMullin soil and 30 percent Medco soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Carney and McNull soils, Rock outcrop on ridges and convex slopes, and soils that are similar to the McMullin soil but have more than 35 percent rock fragments or have bedrock at a depth of less than 12 or more than 20 inches. Also included are small areas of soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches, poorly drained soils near drainageways and on concave slopes, and Medco and McMullin soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective

Figure 9.—An area of McMullin-Medco complex, 12 to 50 percent slopes. The shallow McMullin soil is in the foreground, and the moderately deep Medco soil is in the background.

rooting depth is 12 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Medco soil is moderately deep and moderately well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown and very dark grayish brown cobbly clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing on the McMullin soil are erosion, compaction, the depth to bedrock, droughtiness, and the slope. The main limitations in areas of the Medco soil are erosion, compaction, cobbles and stones on the surface, wetness in winter and spring, droughtiness in summer and fall, and the slope. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because the Medco soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. In places the use of ground equipment is limited by the wetness, the slope, and the included areas of stony soils and Rock outcrop.

Range seeding is suitable on the Medco soil if the site is in poor condition. The main limitations are wetness in winter and spring and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both. The suitability of the McMullin soil for seeding is poor. The main limitations are the depth to bedrock and droughtiness.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the McMullin soil is Loamy Shrub Scabland, 18- to 35-inch precipitation zone, and the one in areas of the Medco soil is Loamy Hills, 20- to 35-inch precipitation zone.

113E—McMullin-Rock outcrop complex, 3 to 35 percent slopes. This map unit is on hillslopes. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 180 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 60 percent McMullin soil and 25 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Lorella and Skookum soils, McNull soils on north-facing slopes, Carney and Medco soils on concave slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McMullin soil but have more than 35 percent rock fragments or are less than 12 inches or more than 20 inches deep over bedrock. Also included are small areas of McMullin soils that have slopes of more than 35 percent. Included areas make up about 15 percent of the total acreage.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from igneous and metamorphic rock. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction, erosion, the Rock outcrop, stones on the surface, droughtiness, and the depth to bedrock. The vegetation suitable for grazing includes bluebunch wheatgrass, Lemmon needlegrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have

achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the stones on the surface and the included areas of Rock outcrop.

This unit is poorly suited to range seeding. The main limitations are the depth to bedrock, droughtiness, the stones on the surface, and the Rock outcrop. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Loamy Shrub Scabland, 18- to 35-inch precipitation zone.

113G—McMullin-Rock outcrop complex, 35 to 60 percent slopes. This map unit is on hillslopes. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 180 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 60 percent McMullin soil and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Lorella and Skookum soils, McNull soils on north-facing slopes, Carney and Medco soils on concave slopes, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of soils that are similar to the McMullin soil but have more than 35 percent rock fragments or are less than 12 inches or more than 20 inches deep over bedrock and McMullin soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 10 percent of the total acreage.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from igneous and metamorphic rock. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are the slope, erosion, compaction, the Rock outcrop, stones on the surface, droughtiness, and the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the stones on the surface, the Rock outcrop, and the slope.

This unit is poorly suited to range seeding. The main limitations are the slope, the depth to bedrock, droughtiness, the stones on the surface, and the Rock outcrop. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The slope and the Rock outcrop limit access by livestock. As a result, the less sloping areas tend to be overgrazed. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Shallow Mountain Slopes, 22- to 30-inch precipitation zone.

114E—McNull loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish

brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes, Medco soils on concave slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches or have more than 35 percent rock fragments. Also included are small areas of McNull soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are erosion, compaction, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir Forest.

114G—McNull loam, 35 to 60 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20

to 40 inches. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes, Medco soils on concave slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches or have more than 35 percent rock fragments. Also included are small areas of McNull soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are the slope, erosion, compaction, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is wet and susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir Forest.

115E—McNull gravelly loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to

160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes, Medco soils on concave slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches or have more than 35 percent rock fragments. Also included are small areas of McNull soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Pine-Douglas Fir-Fescue.

115G—McNull gravelly loam, 35 to 60 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes, Medco soils on concave slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches or have more than 35 percent rock fragments. Also included are small areas of McNull soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Pine-Douglas Fir-Fescue.

116E—McNull-McMullin gravelly loams, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the McNull soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. That on the McMullin soil is mainly grasses, shrubs, and forbs.

This unit is about 55 percent McNull soil and 30 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Medco soils on concave slopes, Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches. Also included are small areas of soils that are similar to the McMullin soil but have bedrock at a depth of less than 12 or more than 20 inches, soils that are similar to the McNull and McMullin soils but have more than 35 percent rock fragments, and McNull and McMullin soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The McNull soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

The McNull soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the McNull soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production on the McNull soil are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding

paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The McMullin soil also is limited by droughtiness and the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue on the McNull soil and bluebunch wheatgrass, Lemmon needlegrass, and pine bluegrass on the McMullin soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Mechanical treatment may not be practical in all areas because of the included Rock outcrop and stony soils.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The McMullin soil is poorly suited to seeding, however, because of droughtiness and the depth to bedrock.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the McNull soil is Pine-Douglas Fir-Fescue, and the one in areas of the McMullin soil is Loamy Shrub Scabland, 18- to 35-inch precipitation zone.

116G—McNull-McMullin gravelly loams, 35 to 60 percent south slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the McNull soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. That on the McMullin soil is mainly grasses, shrubs, and forbs.

This unit is about 55 percent McNull soil and 30 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Medco soils on concave slopes, Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches. Also included are small areas of soils that are similar to the McMullin soil but have bedrock at a depth of less than 12 or more than 20 inches, areas of soils that are similar to the McNull and McMullin soils but have more than 35 percent rock fragments, and McNull and McMullin soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 15 percent of the total acreage.

The McNull soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil.

Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

The McNull soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the McNull soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production on the McNull soil are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are the slope, erosion, and compaction. The McMullin soil also is limited by droughtiness and the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue on the McNull soil and Idaho fescue, bluebunch wheatgrass, and pine bluegrass on the McMullin soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Mechanical treatment generally is not practical because of the slope and the included areas of Rock outcrop and stony soils.

The suitability of this unit for seeding is poor. The main limitations affecting seeding are the slope, droughtiness, and the depth to bedrock in the McMullin soil.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the McNull soil is Pine-Douglas Fir-Fescue, and the one in areas of the McMullin soil is Shallow Mountain Slopes, 22- to 30-inch precipitation zone.

117G—McNull-McMullin complex, 35 to 60 percent north slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the McNull soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. That on the McMullin soil is mainly grasses, shrubs, and forbs.

This unit is about 55 percent McNull soil and 30 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Medco soils on concave slopes, Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches. Also included are small areas of soils that are similar to the McMullin soil but have bedrock at a depth of less than 12 or more than 20 inches, soils that are similar to the McNull and McMullin soils but have more than 35 percent rock fragments, and McNull and McMullin soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 15 percent of the total acreage.

The McNull soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

The McNull soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105 on the McNull soil. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production on the McNull soil are the slope, erosion, compaction, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and

maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are the slope, erosion, and compaction. The McMullin soil also is limited by droughtiness and the depth to bedrock. The vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum on the McNull soil and Idaho fescue and pine bluegrass on the McMullin soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment generally is not practical because of the slope and the included areas of Rock outcrop and stony soils.

The suitability of this unit for seeding is poor. The main limitations are the slope, droughtiness, and the depth to bedrock in the McMullin soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the McNull soil is Douglas Fir Forest, and the one in areas of the McMullin soil is Droughty North, 18- to 35-inch precipitation zone.

118E—McNull-Medco complex, 12 to 50 percent slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the McNull soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. That on the Medco soil is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent McNull soil and 35 percent Medco soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of McMullin soils on ridges and convex slopes, poorly drained soils near drainageways, soils that are similar to the McNull and Medco soils but have bedrock at a depth of more than 40 inches, and soils that are similar to the Medco soil but are 18 to 30 inches deep to a dense layer of clay. Also included are small areas of soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 10 percent of the total acreage.

The McNull soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

The Medco soil is moderately deep and moderately well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown and very dark grayish brown cobbly clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used mainly for livestock grazing or wildlife habitat. The McNull soil also is used for timber production.

The McNull soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the McNull soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production on the McNull soil are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

The Medco soil, which occurs throughout the unit, is subject to severe slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate, especially on south- and southwest-facing slopes. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The Medco soil also is limited by cobbles on the surface and wetness in winter and spring. The vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue on the McNull soil and Idaho fescue, bluebunch wheatgrass, and pine bluegrass on the Medco soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Because the Medco soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. In places the use of ground equipment is limited by the seasonal wetness, the slope, and the included areas of stony soils and Rock outcrop.

Range seeding is suitable on the Medco soil if the site is in poor condition. The main limitations are wetness in winter and spring and droughtiness in summer and fall. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The vegetative site in areas of the McNull soil is Pine-Douglas Fir-Fescue, and the one in areas of the Medco soil is Loamy Hills, 20- to 35-inch precipitation zone.

119F—McNull-Medco complex, high precipitation, 12 to 50 percent slopes. This map unit is on hillslopes. Elevation is 2,500 to 4,000 feet. The mean annual precipitation is 35 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent McNull soil and 35

percent Medco soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of McMullin soils on ridges and convex slopes, poorly drained soils near drainageways, soils that are similar to the McNull and Medco soils but have bedrock at a depth of more than 40 inches, and soils that are similar to the Medco soil but are 18 to 30 inches deep to a dense layer of clay. Also included are small areas of McNull and Medco soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 15 percent of the total acreage.

The McNull soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

The Medco soil is moderately deep and moderately well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown cobbly clay loam about 7 inches thick. The next layer is dark brown cobbly clay loam about 6 inches thick. The subsoil is brown clay about 22 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the McNull soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85 on the Medco soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. The bedrock in both soils and the dense layer of clay in the Medco soil restrict root growth. As a result, windthrow is a hazard. The Medco soil also is limited by seasonal wetness and slumping.

The perched seasonal high water table in the Medco soil limits the use of equipment to dry periods. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

The Medco soil is subject to severe slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and

maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate, especially on south- and southwest-facing slopes. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced in the more sloping areas by providing artificial shade for seedlings. The seasonal wetness of the Medco soil increases the seedling mortality rate. Also, seedlings planted in the less fertile clayey subsoil grow poorly.

The main limitations affecting livestock grazing are compaction and erosion on both soils and the seasonal wetness of the Medco soil. The native vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Because the Medco soil remains wet for long periods in spring, grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Pine-Douglas Fir-Fescue.

120B—Medco clay loam, 3 to 7 percent slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in alluvium and colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown and very dark grayish brown clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Carney and McNull soils, McMullin soils and Rock outcrop on ridges and convex slopes, soils that are similar to the Medco soil but are poorly drained and are near drainageways and on concave slopes, and soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Medco soils that have slopes of more than 7 percent. Included areas make up about 15 percent of the total acreage.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is slow, and the hazard of water erosion is slight. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used for hay and pasture, livestock grazing, and wildlife habitat.

This unit is suited to hay and pasture. It is limited mainly by wetness in winter and spring, droughtiness in summer and fall, and the very slow permeability in the subsoil. In summer, irrigation is needed for the maximum production of hay and pasture. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable in the less sloping areas. For the efficient application and removal of surface irrigation water, land leveling is needed; however, deep cuts can expose the bedrock or the clayey subsoil. To prevent overirrigation and excessive erosion or development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective

grazing, and reduce the extent of clumpy growth.

The ability of tile drains to remove subsurface water from the soil is limited because of the very slow permeability. Land smoothing and open ditches can reduce surface wetness.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting livestock grazing are compaction, wetness in winter and spring, and droughtiness in summer and fall. The vegetation suitable for grazing includes California oatgrass, Idaho fescue, and bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because this soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment on this unit should be limited to dry periods.

Range seeding is suitable if the site is in poor condition. The main limitations are wetness in winter and spring and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The vegetative site is Clayey Hills, 20- to 35-inch precipitation zone.

120C—Medco clay loam, 7 to 12 percent slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in alluvium and colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown and very dark grayish brown clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Carney and McNull soils, McMullin soils and Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Medco soils that have slopes of less than 7 or more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used for hay and pasture, livestock grazing, and wildlife habitat.

This unit is suited to hay and pasture. It is limited mainly by the slope, wetness in winter and spring, droughtiness in summer and fall, and the very slow permeability in the subsoil. In summer, irrigation is needed for the maximum production of hay and pasture. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion or development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

The ability of tile drains to remove subsurface water from the soil is limited because of the very slow permeability and the slope. Wetness can be reduced by interceptor drains.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting livestock grazing are compaction, wetness in winter and spring, and

droughtiness in summer and fall. The vegetation suitable for grazing includes California oatgrass, Idaho fescue, and bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because this soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment on this unit should be limited to dry periods.

Range seeding is suitable if the site is in poor condition. The main limitations are wetness in winter and spring and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Clayey Hills, 20- to 35-inch precipitation zone.

121E—Medco cobbly clay loam, 12 to 50 percent north slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in alluvium and colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown and very dark grayish brown cobbly clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Carney and McNull soils, McMullin soils and Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Medco soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used mainly for livestock grazing or wildlife habitat. The less sloping parts of a few areas are used for pasture.

The main limitations affecting livestock grazing are compaction, erosion, wetness in winter and spring, droughtiness in summer and fall, the cobbly surface layer, and the slope. The vegetation suitable for grazing includes California oatgrass, Idaho fescue, and bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because this soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In some areas the use of ground equipment and access by livestock are limited by the seasonal wetness, the cobbles on the surface, and the slope.

Range seeding is suitable if the site is in poor condition. The main limitations are the cobbly surface layer, wetness in winter and spring, and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Clayey Hills, 20- to 35-inch precipitation zone.

122E—Medco cobbly clay loam, 12 to 50 percent south slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in alluvium and colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual

temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown and very dark grayish brown cobbly clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Carney and McNull soils, McMullin soils and Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Medco soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used mainly for livestock grazing or wildlife habitat. Some of the less sloping areas are used for pasture.

The main limitations affecting livestock grazing are compaction, erosion, wetness in winter and spring, the cobbly surface layer, and the slope. The vegetation suitable for grazing includes bluebunch wheatgrass, Idaho fescue, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because this soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment and access by livestock are limited by the seasonal wetness, the cobbles on the surface, and the slope. Constructing trails or walkways allows livestock to graze in areas where access is limited.

Range seeding is suitable if the site is in poor condition. The main limitations are the cobbly surface layer, wetness in winter and spring, and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

123F—Medco clay loam, high precipitation, 12 to 50 percent north slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 2,500 to 4,000 feet. The mean annual precipitation is 35 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown clay loam about 7 inches thick. The next layer is dark brown cobbly clay loam about 6 inches thick. The subsoil is brown clay about 22 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of McMullin soils on ridges and convex slopes, poorly drained soils near drainageways, and McNull soils on convex slopes. Also included are small areas of soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches or are 18 to 30 inches deep to a dense layer of clay and Medco soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

The main limitations affecting timber production are erosion, compaction, slumping, the seasonal wetness, and plant competition. Also, the dense layer of clay restricts root growth. As a result, windthrow is a hazard.

The perched seasonal high water table limits the use of equipment to dry periods. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

This unit is subject to severe slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants. The seasonal wetness increases the seedling mortality rate. Also, seedlings planted in the less fertile clayey subsoil grow poorly.

The main limitations affecting livestock grazing are compaction, erosion, and the seasonal wetness. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Because the soil remains wet for long periods in spring, grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir Forest.

124F—Medco clay loam, high precipitation, 12 to 50 percent south slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 2,500 to 4,000 feet. The mean annual precipitation is 35 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown clay loam about 7 inches thick. The next layer is dark brown cobbly clay loam about 6 inches thick. The subsoil is brown clay about 22 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of McMullin soils on ridges and convex slopes, poorly drained soils near drainageways, and McNull soils on convex slopes. Also included are small areas of soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches or are 18 to 30 inches deep to a dense layer of clay and Medco soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting

depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

The main limitations affecting timber production are erosion, compaction, slumping, the seasonal wetness, plant competition, and seedling mortality. Also, the dense layer of clay restricts root growth. As a result, windthrow is a hazard.

The perched seasonal high water table limits the use of equipment to dry periods. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

This unit is subject to severe slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. The seasonal wetness increases the seedling mortality rate. Also, seedlings planted in the less fertile clayey subsoil grow poorly.

The main limitations affecting livestock grazing are compaction, erosion, and the seasonal wetness. The native vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Because the soil remains wet for long periods in spring, grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Pine-Douglas Fir-Fescue.

125C—Medco-McMullin complex, 1 to 12 percent slopes. This map unit is on hillslopes. Elevation is 1,300 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the Medco soil is

mainly hardwoods and an understory of grasses, shrubs, and forbs. That on the McMullin soil is mainly grasses, shrubs, and forbs.

This unit is about 55 percent Medco soil and 30 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Carney and McNull soils, Rock outcrop on ridges and convex slopes, and soils that are similar to the McMullin soil but have more than 35 percent rock fragments or have bedrock at a depth of less than 12 or more than 20 inches. Also included are small areas of soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches, poorly drained soils near drainageways and on concave slopes, and Medco and McMullin soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

The Medco soil is moderately deep and moderately well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown and very dark grayish brown cobbly clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is slow, and the hazard of water erosion is slight. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing on the Medco soil are compaction, cobbles and stones on the surface, and wetness in winter and spring. The main limitations in areas of the McMullin soil are compaction, the depth to bedrock, cobbles and stones on the surface, and droughtiness. The vegetation suitable for grazing includes California oatgrass, Idaho fescue, and bluegrass on the Medco soil and bluebunch wheatgrass and pine bluegrass on the McMullin soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because the Medco soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment is limited by the seasonal wetness and the included areas of stony soils and Rock outcrop.

Range seeding is suitable on the Medco soil if the site is in poor condition. The main limitations are the cobbly surface layer, wetness in winter and spring, and droughtiness in summer and fall. The suitability of the McMullin soil for seeding is poor. The main limitations are the depth to bedrock and droughtiness. The included areas of stony soils and Rock outcrop also are limitations. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the Medco soil is Clayey Hills, 20- to 35-inch precipitation zone, and the one in areas of the McMullin soil is Loamy Shrub Scabland, 18- to 35-inch precipitation zone.

125F—Medco-McMullin complex, 12 to 50 percent slopes. This map unit is on hillslopes. Elevation is 1,300 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the Medco soil is mainly hardwoods and an understory of grasses, shrubs, and forbs. That on the McMullin soil is mainly grasses, shrubs, and forbs.

This unit is about 50 percent Medco soil and 30 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Carney and McNull soils, Rock outcrop on ridges and convex

slopes, and soils that are similar to the McMullin soil but have more than 35 percent rock fragments or have bedrock at a depth of less than 12 or more than 20 inches. Also included are small areas of soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches, poorly drained soils near drainageways and on concave slopes, and Medco and McMullin soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

The Medco soil is moderately deep and moderately well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown and very dark grayish brown cobbly clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing on the Medco soil are compaction, erosion, cobbles and stones on the surface, wetness in winter and spring, droughtiness in summer and fall, and the slope. The main limitations in areas of the McMullin soil are compaction, erosion, cobbles and stones on the surface, the depth to bedrock, droughtiness, and the slope. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because the Medco soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment is limited by the seasonal wetness, the slope, and the included stony soils and Rock outcrop.

Range seeding is suitable on the Medco soil if the site is in poor condition. The main limitations are the cobbly surface layer, wetness in winter and spring, and droughtiness in summer and fall. The suitability of the McMullin soil for seeding is poor. The main limitations are the depth to bedrock and droughtiness. The included areas of stony soils and Rock outcrop also are limitations. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the Medco soil is Loamy Hills, 20- to 35-inch precipitation zone, and the one in areas of the McMullin soil is Loamy Shrub Scabland, 18- to 35-inch precipitation zone.

126F—Medco-McNull complex, 12 to 50 percent slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the Medco soil is mainly hardwoods and an understory of grasses, shrubs, and forbs. That on the McNull soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Medco soil and 30 percent McNull soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of McMullin soils on ridges and convex slopes, poorly drained soils near drainageways, soils that are similar to the McNull and Medco soils but have bedrock at a depth of more than 40 inches, and soils that are similar to the Medco soil but are 18 to 30 inches deep to a dense layer of clay. Also included are small areas of McNull and Medco soils that have slopes of less than 12 or more than 50

percent. Included areas make up about 15 percent of the total acreage.

The Medco soil is moderately deep and moderately well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown and very dark grayish brown cobbly clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

The McNull soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for livestock grazing or wildlife habitat. The McNull soil also is used for timber production.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The Medco soil also is limited by wetness in winter and spring. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass on the Medco soil and Idaho fescue, tall trisetum, and western fescue on the McNull soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Because the Medco soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. In places the use of ground equipment is limited by the seasonal wetness, the slope, and the included areas of stony soils and Rock outcrop.

Range seeding is suitable on the Medco soil if the site is in poor condition. The main limitations are wetness in winter and spring and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The McNull soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the McNull soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production on the McNull soil are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep

yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

The Medco soil, which occurs throughout the unit, is subject to severe slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate, especially on south- and southwest-facing slopes. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site in areas of the Medco soil is Loamy Hills, 20- to 35-inch precipitation zone, and the one in areas of the McNull soil is Pine-Douglas Fir-Fescue.

127A—Medford silty clay loam, 0 to 3 percent slopes. This very deep, moderately well drained soil is on stream terraces. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 125 to 180 days. The vegetation in areas that have not been cultivated is mainly grasses and forbs.

Typically, the surface layer is very dark brown silty clay loam about 12 inches thick. The upper 10 inches of the subsoil is very dark brown silty clay. The next 31 inches is dark brown and dark yellowish brown silty clay loam and clay loam. The lower part to a depth of 71 inches is dark yellowish brown sandy clay loam. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Abin, Evans, Newberg, and Camas soils on flood plains; Gregory soils on the lower terraces and on concave slopes; Coleman soils on the higher terraces; and Central Point soils. Also included are small areas of Medford soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Medford soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The water table fluctuates between depths of 4 and 6 feet from December through April.

This unit is used mainly for irrigated crops, such as alfalfa hay, tree fruit, and small grain. Other crops include corn for silage and sugar beet seed. Some areas are used for homesite development, grass-legume hay, or pasture.

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability and wetness in winter and spring. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

A subsurface drainage system can lower the water table if a suitable outlet is available. Land smoothing and open ditches can reduce surface wetness.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes.

Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the moderately slow permeability, the wetness, the shrink-swell potential, and low strength.

The moderately slow permeability and depth to the water table increase the possibility that septic tank absorption fields will fail. The moderately slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields.

A drainage system may be needed if roads and building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

128B—Medford clay loam, gravelly substratum, 0 to 7 percent slopes. This very deep, moderately well drained soil is on stream terraces. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 125 to 180 days. The vegetation in areas that have not been cultivated is mainly grasses and forbs.

Typically, the surface layer is very dark gray clay loam about 9 inches thick. The subsoil is very dark grayish brown clay about 31 inches thick. The substratum to a depth of 62 inches is light olive brown very gravelly clay loam. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Abin, Evans, Newberg, and Camas soils on flood plains; Gregory soils on the lower terraces and on concave slopes; Coleman soils on the higher terraces; and Central Point soils. Also included are small areas of Medford soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Medford soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The water table fluctuates between depths of 3 and 5 feet from December through April.

This unit is used mainly for irrigated crops, such as alfalfa hay, tree fruit, and small grain. Other crops include corn for silage and sugar beet seed. Some areas are used for homesite development, grass-legume hay, or pasture.

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability and wetness in winter and spring. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

A subsurface drainage system can lower the water table if a suitable outlet is available. Land smoothing and open ditches can reduce surface wetness.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development

are the moderately slow permeability, the wetness, the shrink-swell potential, and low strength.

The moderately slow permeability and depth to the water table increase the possibility that septic tank absorption fields will fail. The moderately slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields.

A drainage system may be needed if roads and building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

129B—Merlin extremely stony loam, 1 to 8 percent slopes. This shallow, well drained soil is on plateaus. It formed in residuum derived dominantly from andesite and tuff. Elevation is 4,000 to 4,800 feet. The mean annual precipitation is 17 to 18 inches, the mean annual temperature is 43 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, shrubs, and forbs.

Typically, the surface layer is dark brown extremely stony loam about 11 inches thick. The subsoil is dark brown clay about 2 inches thick. Bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is very gravelly or very cobbly.

Included in this unit are small areas of Bly and Royst soils and soils that are similar to the Merlin soil but have bedrock within a depth of 10 inches or have a subsoil of loam. Also included are small areas of Merlin soils that have slopes of more than 8 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Merlin soil. Available water capacity is about 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is moderate.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction, stones on the surface, droughtiness, and the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, pine bluegrass, and bluebunch wheatgrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the stones on the surface.

This unit is poorly suited to range seeding. The main limitations are droughtiness, the stones on the surface, and the depth to bedrock. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The vegetative site is Loamy Juniper Scabland, 20- to 30-inch precipitation zone.

130E—Musty-Goolaway complex, 12 to 35 percent slopes. This map unit is on ridges. Elevation is 2,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Musty soil and 20 percent Goolaway soil. The Goolaway soil commonly has slopes of more than 20 percent. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Josephine, Siskiyou, and Speaker soils; Pollard soils on concave slopes; Rock outcrop; soils that are similar to the Musty soil but have bedrock within a depth of 20 inches; and soils that are similar to the Goolaway soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Musty and Goolaway soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Musty soil is moderately deep and well drained. It formed in colluvium derived dominantly from schist.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 12 inches thick. The subsoil is dark grayish brown very cobbly loam about 17 inches thick. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly, very cobbly, or stony.

Permeability is moderate in the Musty soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Goolaway soil is moderately deep and well drained. It formed in colluvium derived dominantly from schist. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and incense cedar. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Musty soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 80.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115 on the Goolaway soil. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate on south- and southwest-facing slopes. The large number of rock fragments in the Musty soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

131F—Musty-Goolaway complex, 35 to 50 percent north slopes. This map unit is on hillslopes. Elevation is 2,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to

50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 40 percent Musty soil and 35 percent Goolaway soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Josephine, Siskiyou, and Speaker soils; Pollard soils on the less sloping parts of the landscape and on concave slopes; and soils that are similar to the Musty and Goolaway soils but have bedrock at a depth of more than 40 inches. Also included are small areas of and Musty and Goolaway soils that have slopes of less than 35 or more than 50 percent. Included areas make up about 25 percent of the total acreage.

The Musty soil is moderately deep and well drained. It formed in colluvium derived dominantly from schist. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 12 inches thick. The subsoil is dark grayish brown very cobbly loam about 17 inches thick. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly or very cobbly.

Permeability is moderate in the Musty soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Goolaway soil is moderately deep and well drained. It formed in colluvium derived dominantly from schist. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and sugar pine. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Musty soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Goolaway soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed

road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

132F—Musty-Goolaway complex, 35 to 50 percent south slopes. This map unit is on hillslopes. Elevation is 2,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Musty soil and 30 percent Goolaway soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Josephine, Siskiyou, and Speaker soils; Pollard soils on the less sloping parts of the landscape and on concave slopes; and soils that are similar to the Musty and Goolaway soils but have bedrock at a depth of more than 40 inches. Also included are small areas of Musty and Goolaway soils that have slopes of less than 35 or more than 50 percent. Included areas make up about 25 percent of the total acreage.

The Musty soil is moderately deep and well drained. It formed in colluvium derived dominantly from schist. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 12 inches thick. The subsoil is dark grayish brown very cobbly loam about 17 inches thick. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly or very cobbly.

Permeability is moderate in the Musty soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Goolaway soil is moderately deep and well drained. It formed in colluvium derived dominantly from schist. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Musty soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 80.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115 on the Goolaway soil. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion.

Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Musty soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Black Oak Forest.

133A—Newberg fine sandy loam, 0 to 3 percent slopes. This very deep, somewhat excessively drained soil is on flood plains. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown fine sandy loam about 17 inches thick. The upper 13 inches of the substratum is dark brown sandy loam. The next 12 inches is dark brown fine sand. The lower part to a depth of 60 inches is dark grayish brown loamy sand. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Abin, Camas, and Evans soils; Cove soils on concave slopes; Central Point, Medford, Takilma soils on terraces; and soils that are similar to the Newberg soil but have a gravelly or very gravelly substratum. Also included are small areas of Riverwash, poorly drained soils, and Newberg soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Newberg soil and rapid in the lower part. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. The substratum can restrict the penetration of roots, however, because of droughtiness. Runoff is slow, and the hazard of water erosion is slight. This soil is occasionally flooded for brief periods from December through March.

This unit is used mainly for irrigated crops, such as alfalfa hay and small grain. Other crops include corn for silage. Some areas are used for grass-legume hay, pasture, or homesite development.

This unit is suited to irrigated crops. It is limited mainly by the hazard of flooding. This hazard can be reduced by levees, dikes, and diversions.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, leveling is needed in the more sloping areas. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent. The use of pipe, ditch lining, or drop structures in irrigation ditches facilitates irrigation and reduces the hazard of ditch erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface

crusting and compaction can be minimized by returning crop residue to the soil.

Maintaining a protective plant cover in winter reduces the soil loss resulting from flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the flooding and the rapid permeability in the substratum.

This unit is poorly suited to standard systems of waste disposal because of a poor filtering capacity in the substratum and the hazard of flooding. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils. Dikes and channels that have outlets for floodwater can protect buildings and onsite sewage disposal systems from flooding.

In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating as soon as possible in disturbed areas around construction sites helps to control soil blowing. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls.

Establishing plants is difficult in areas where the surface layer has been removed. Mulching and applying fertilizer help to establish plants in cut areas. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

Roads and streets should be constructed above the expected level of flooding. The risk of flooding has been reduced in some areas by the construction of large dams and reservoirs upstream.

The vegetative site is Loamy Flood Plain, 18- to 30-inch precipitation zone.

134F—Norling-Acker complex, 35 to 55 percent south slopes. This map unit is on hillslopes. Elevation is 2,400 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Norling soil and 35 percent Acker soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Gravecreek, and Pearsoll soils; Dumont soils on the less sloping parts of the landscape and on concave slopes; and Atring and Kanid soils on the more sloping parts of the landscape and on convex slopes. Also included are small areas of Acker and Norling soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 20 percent of the total acreage.

The Norling soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is brown very gravelly loam about 5 inches thick. The next layer is brown gravelly clay loam about 5 inches thick. The upper 12 inches of the subsoil is yellowish brown gravelly clay loam. The lower 7 inches is yellowish brown very cobbly clay loam. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Norling soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Acker soil is very deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 4 inches thick. The surface layer is brown gravelly loam about 8 inches thick. The next layer is yellowish brown gravelly clay loam about 9 inches thick. The upper 11 inches of the subsoil is yellowish red gravelly clay loam. The lower 32 inches is strong brown gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Acker soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes golden chinkapin, Whipplevine, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site

index for Douglas fir is 125 on the Norling soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Acker soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site is Douglas Fir-Madrone-Chinkapin Forest.

135E—Oatman cobbly loam, 12 to 35 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,800 to 6,500 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark brown cobbly loam about 16 inches thick. The subsoil is dark brown very cobbly sandy loam about 14 inches thick. The substratum to a depth of 60 inches also is dark brown very cobbly sandy loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Rock outcrop and Rubble land on ridges and convex slopes, Otwin soils on ridges and on the more sloping parts of the landscape, soils that are similar to the Oatman soil but have bedrock at a depth of 40 to 60 inches or have less than 35 percent rock fragments, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Oatman soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Oatman soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and Shasta red fir. Other species that grow on this unit include western white pine, Douglas fir, and ponderosa pine. The understory vegetation includes sierra chinkapin, western princes pine, big huckleberry, and sedge.

On the basis of a 50-year site curve, the mean site

index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Shasta red fir is 60. The yield at culmination of the mean annual increment is 29,960 cubic feet per acre in a fully stocked, even-aged stand of trees at 140 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine, Shasta red fir, or lodgepole pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes sedge, mountain brome, tall trisetum, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is Shasta Fir-White Pine-Princes Pine Forest.

135G—Oatman cobbly loam, 35 to 65 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,800 to 6,500 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark brown cobbly loam about 16 inches thick. The subsoil is dark brown very cobbly sandy loam about 14 inches thick. The substratum to a depth of 60 inches also is dark brown very cobbly sandy loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Rock outcrop, Rubble land, and Otwin soils on ridges and convex slopes. Also included are small areas of soils that are similar to the Oatman soil but have bedrock at a depth of 40 to 60 inches or have less than 35 percent rock fragments and Oatman soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Oatman soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and

Shasta red fir. Other species that grow on this unit include western white pine, Douglas fir, and ponderosa pine. The understory vegetation includes sierra chinkapin, western princes pine, big huckleberry, and sedge.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Shasta red fir is 60. The yield at culmination of the mean annual increment is 29,960 cubic feet per acre in a fully stocked, even-aged stand of trees at 140 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine, Shasta red fir, or lodgepole pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes sedge, mountain brome, tall trisetum, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is Shasta Fir-White Pine-Princes Pine Forest.

136E—Oatman cobbly loam, 12 to 35 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,800 to 6,500 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark brown cobbly loam about 16 inches thick. The subsoil is dark brown very cobbly sandy loam about 14 inches thick. The substratum to a depth of 60 inches also is dark brown very cobbly sandy loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Rock outcrop

and Rubble land on ridges and convex slopes, Otwin soils on ridges and on the more sloping parts of the landscape, and soils that are similar to the Oatman soil but have bedrock at a depth of 40 to 60 inches or have less than 35 percent rock fragments. Also included are small areas of poorly drained soils near drainageways and on concave slopes and Oatman soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Oatman soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and Shasta red fir. Other species that grow on this unit include western white pine, Douglas fir, and ponderosa pine. The understory vegetation includes sierra chinkapin, western princes pine, and sedge.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Shasta red fir is 55. The yield at culmination of the mean annual increment is 26,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 140 years.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes sedge, mountain brome, Alaska oniongrass, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is White Fir-Shasta Fir Forest.

137C—Oatman cobbly loam, depressional, 0 to 12 percent slopes. This very deep, well drained soil is on plateaus. It formed in colluvium and residuum derived from andesite and volcanic ash. Elevation is 4,900 to

5,200 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark brown cobbly loam about 16 inches thick. The subsoil is dark brown very cobbly sandy loam about 14 inches thick. The substratum to a depth of 60 inches also is dark brown very cobbly sandy loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Rock outcrop, Otwin and Hoxie soils, and soils that are similar to the Oatman soil but have bedrock at a depth of 40 to 60 inches or have less than 35 percent rock fragments. Also included are small areas of Oatman soils that have slopes of more than 12 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Oatman soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and lodgepole pine. Other species that grow on this unit include ponderosa pine, western white pine, and Douglas fir. The understory vegetation includes onesided wintergreen, western princes pine, and sedge.

On the basis of a 50-year site curve, the mean site index for white fir is 70. The yield at culmination of the mean annual increment is 11,410 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine, Shasta red fir, and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes sedge, mountain brome, western fescue, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is White Fir-White Pine Forest.

138C—Oatman-Otwin complex, 0 to 12 percent slopes. This map unit is on plateaus. Elevation is 4,800 to 6,500 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 70 percent Oatman soil and 20 percent Otwin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop, Klamath soils near drainageways and on concave

slopes, soils that are similar to the Otwin soil but have bedrock at a depth of 40 to 60 inches, and soils that are similar to the Oatman soil but have less than 35 percent rock fragments. Also included are small areas of Oatman and Otwin soils that have slopes of more than 12 percent. Included areas make up about 10 percent of the total acreage.

The Oatman soil is very deep and well drained. It formed in colluvium and residuum derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark brown cobbly loam about 16 inches thick. The subsoil is dark brown very cobbly sandy loam about 14 inches thick. The substratum to a depth of 60 inches also is dark brown very cobbly sandy loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is very cobbly or stony.

Permeability is moderate in the Oatman soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Otwin soil is moderately deep and well drained. It formed in colluvium and residuum derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark grayish brown stony sandy loam about 3 inches thick. The next layer is dark yellowish brown very cobbly sandy loam about 10 inches thick. The subsoil is dark brown very cobbly sandy loam about 15 inches thick. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderately rapid in the Otwin soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and Shasta red fir. Other species that grow on this unit include western white pine, Douglas fir, and ponderosa pine. The understory vegetation includes sierra chinkapin, western princes pine, big huckleberry, and sedge.

On the basis of a 50-year site curve, the mean site index for white fir is 75 on the Oatman soil. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Shasta red fir is 50 on the Oatman soil. The yield at culmination of the mean annual increment is 23,940 cubic feet per acre in a fully stocked, even-aged stand of trees at 140 years.

On the basis of a 50-year site curve, the mean site index for white fir is 65 on the Otwin soil. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Shasta red fir is 40 on the Otwin soil. The yield at culmination of the mean annual increment is 18,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 140 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine, Shasta red fir, and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes sedge, mountain brome, tall trisetum, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the

proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is Shasta Fir-White Pine-Princes Pine Forest.

139A—Padigan clay, 0 to 3 percent slopes. This very deep, poorly drained soil is in basins. It formed in alluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 3,500 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is very dark gray clay about 12 inches thick. The next layer is very dark gray and very dark grayish brown, calcareous clay about 24 inches thick. The subsoil to a depth of 60 inches is grayish brown, calcareous clay and gravelly sandy clay loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Carney and Darow soils on convex slopes; Cove and Gregory soils near drainageways; Coker, Medford, and Phoenix soils; and soils that are similar to the Padigan soil but have bedrock at a depth of 40 to 60 inches. Also included are small areas of Padigan soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Padigan soil. Available water capacity is about 8 inches. The effective rooting depth is limited by the water table, which is 1.0 foot above to 0.5 foot below the surface from November through May. Runoff is ponded, and the hazard of water erosion is slight.

This unit is used mainly for pasture. It also is used for tree fruit, hay, and homesite development.

This unit is suited to permanent pasture. It is limited mainly by the wetness, the high content of clay, and a slow rate of water intake. Crops that require good drainage can be grown if a properly designed drainage system is installed. The ability of tile drains to remove subsurface water from the soil is limited because of the very slow permeability.

In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the very slow permeability and the water table, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land smoothing and open ditches can reduce surface wetness. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is poorly suited to homesite development. The main limitations are the wetness, a high shrink-swell potential, the very slow permeability, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the wetness and the very slow permeability. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

A drainage system is needed if roads or building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking

and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Poorly Drained Bottom.

140G—Pearsoll-Dubakella complex, rocky, 20 to 60 percent slopes. This map unit is on hillslopes. Elevation is 1,200 to 4,100 feet. The mean annual precipitation is 35 to 60 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the Pearsoll soil is mainly grasses, shrubs, and forbs and a few scattered conifers. That on the Dubakella soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Pearsoll soil and 20 percent Dubakella soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop on ridges and convex slopes; Acker, Beekman, Gravecreek, Josephine, Norling, and Speaker soils; and, on concave slopes and foot slopes, soils that are similar to the Dubakella soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Pearsoll and Dubakella soils that have slopes of less than 20 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

The Pearsoll soil is shallow and well drained. It formed in colluvium derived dominantly from peridotite and serpentinite. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown extremely stony clay loam about 7 inches thick. The subsoil is dark brown very cobbly and extremely cobbly clay about 12 inches thick. Bedrock is at a depth of about 19 inches. The depth to bedrock ranges from 10 to 20 inches.

Permeability is slow in the Pearsoll soil. Available water capacity is about 1 inch. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The Dubakella soil is moderately deep and well drained. It formed in colluvium derived dominantly from peridotite and serpentinite. Typically, the surface layer is dark reddish brown very stony clay loam about 11 inches thick. The subsoil is dark reddish brown very cobbly clay about 20 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Dubakella soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for wildlife habitat and limited timber production. It is poorly suited to timber production. The plant community on the Pearsoll soil includes scattered Jeffrey pine and an occasional incense cedar or Douglas fir. The understory vegetation is mainly sheep fescue, California fescue, and Indian dream fern.

The plant community on the Dubakella soil includes Douglas fir, Jeffrey pine, incense cedar, and Pacific madrone. The understory vegetation is mainly canyon live oak, common snowberry, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 80 on the Dubakella soil. The yield at culmination of the mean annual increment is 4,060 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 23,360 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

The main limitations affecting timber production on the Dubakella soil are the slope, low fertility, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Rock outcrop and stones can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant

cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer, the large number of rock fragments in the soil, and the low available water capacity increase the seedling mortality rate. A high content of magnesium and low content of calcium also increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Jeffrey pine and incense cedar seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site in areas of the Pearsoll soil is Shallow Serpentine, 30- 40-inch precipitation zone, and the one in areas of the Dubakella soil is Douglas Fir-Pine Forest, Serpentine.

141A—Phoenix clay, 0 to 3 percent slopes. This moderately deep, poorly drained soil is on alluvial fans. It formed in alluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 1,700 feet. The mean annual precipitation is 18 to 25 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 160 to 180 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is dark gray clay about 20 inches thick. The subsoil is dark gray and gray clay about 20 inches thick. Weathered bedrock is at a depth of about 40 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Carney soils on convex slopes, Padigan soils on concave slopes, Coker and Winlo soils, and soils that are similar to the Phoenix soil but have bedrock at a depth of 40 to 60 inches. Also included are small areas of Phoenix soils that have slopes of more than 3 percent. Included areas make up about 10 percent of the total acreage.

Permeability is very slow in the Phoenix soil. Available water capacity is about 4 inches. The effective rooting depth is limited by the water table, which is within a depth of 0.5 foot from December through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for hay and pasture or for tree fruit. It also is used for homesite development.

This unit is suited to permanent pasture. It is limited mainly by wetness, the high content of clay, and a slow rate of water intake. The ability of tile drains to remove subsurface water from the soil is limited because of the very slow permeability.

In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the very slow permeability and depth to the water table, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land smoothing and open ditches can reduce surface wetness. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for

tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is poorly suited to homesite development. The main limitations are the wetness, a high shrink-swell potential, the very slow permeability, the depth to bedrock, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the wetness, the depth to bedrock, and the very slow permeability. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

A drainage system is needed if roads or building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Poorly Drained Bottom.

142C—Pinehurst loam, 3 to 12 percent slopes. This very deep, well drained soil is on plateaus. It formed in colluvium derived from basalt and andesite. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 15 inches thick. The subsoil to a depth of 60 inches is dark reddish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Included in this unit are small areas of Kanutchan and Sibannac soils in basins and near drainageways, Bybee and Tatouche soils on concave slopes, Farva and Woodseye soils and Rock outcrop on convex slopes, and soils that are similar to the Pinehurst soil but have bedrock within a depth of 60 inches. Also included are small areas of Pinehurst soils that have slopes of less than 3 or more than 12 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately slow in the Pinehurst soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include Pacific yew and sierra chinkapin. The understory vegetation includes onesided wintergreen, cascade Oregongrape, and American twinflower.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in

summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Yew Forest.

143E—Pinehurst loam, 12 to 35 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from basalt and andesite. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 15 inches thick. The subsoil to a depth of 60 inches is dark reddish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Included in this unit are small areas of Kanutchan and Sibannac soils in basins and near drainageways, Bybee and Tatouche soils on concave slopes, Farva and Woodseye soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Pinehurst soil but have bedrock within a depth of 60 inches. Also included are small areas of Pinehurst soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Pinehurst soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include Pacific yew and sierra chinkapin. The understory vegetation includes onesided wintergreen, cascade Oregongrape, and American twinflower.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,570 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted,

proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Yew Forest.

144E—Pinehurst loam, 12 to 35 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from basalt and andesite. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 15 inches thick. The subsoil to a depth of 60 inches is dark reddish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Included in this unit are small areas of Kanutchan and Sibannac soils in basins and near drainageways, Bybee and Tatouche soils on concave slopes, Farva and Woodseye soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Pinehurst soil but have bedrock within a depth of 60 inches. Also included are small areas of Pinehurst soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Pinehurst soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include ponderosa pine and incense cedar. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

145C—Pinehurst-Greystoke complex, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 3,500 to 4,800 feet. The mean annual precipitation is 20 to 30 inches, the mean annual temperature is 42 to 46 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 65 percent Pinehurst soil and 20 percent Greystoke soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Merlin and Royst soils, Rock outcrop and Kanutchan soils near drainageways and on concave slopes, and soils that are similar to the Pinehurst soil but have bedrock within a depth of 60 inches. Also included are small areas of Pinehurst and Greystoke soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

The Pinehurst soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 15 inches thick. The subsoil is dark reddish brown clay loam about 45 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Pinehurst soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Greystoke soil is deep and well drained. It formed in residuum and colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is dark reddish brown very cobbly loam about 10 inches thick. The upper 10 inches of the subsoil also is dark reddish brown very cobbly loam. The lower 19 inches is dark reddish brown extremely gravelly clay loam. Weathered bedrock is at a depth of about 42 inches. The depth to bedrock ranges from 40 to 60 inches.

Permeability is moderately slow in the Greystoke soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, white fir, and sugar pine. The understory vegetation includes tall Oregon grape, pachystima, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Pinehurst soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 95 on the Pinehurst soil. The yield at culmination of the mean annual increment is 3,760 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 43,160 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90 on the Greystoke soil. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged

stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90 on the Greystoke soil. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir-Mixed Pine-Sedge Forest.

146—Pits, gravel. This map unit consists of sand and gravel pits and quarries. The pits are on flood plains and terraces along the major streams and rivers in the survey area. They are a major source of aggregate used in the construction of roads.

The quarries are on foothills and uplands. They are an excellent source of the various kinds of rock that are used for most of the roads built in the survey area.

This unit is not assigned to a vegetative site.

147C—Pokegema-Woodcock complex, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 3,800 to 6,600 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 40 to 43 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 70 percent Pokegema soil and 20 percent Woodcock soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Merlin soils, Rock outcrop, Klamath soils near drainageways and on concave slopes, soils that are similar to the Pokegema soil but have bedrock at a depth of less than 40 or more than 60 inches, and soils that are similar to the Woodcock soil but have bedrock within a depth of 60 inches. Also included are small areas of Pokegema and Woodcock soils that have slopes of more than 12 percent. Included areas make up about 10 percent of the total acreage.

The Pokegema soil is deep and well drained. It formed in residuum derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is dark reddish brown loam about 8 inches thick. The upper 8 inches of the subsoil is dark reddish brown clay loam. The lower 22 inches is dark reddish brown gravelly clay. The substratum is dark reddish brown and reddish

brown gravelly clay about 14 inches thick. Weathered bedrock is at a depth of about 52 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Pokegema soil. Available water capacity is about 6 inches. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

The Woodcock soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 4 inches thick. The next layer is dark reddish brown very gravelly loam about 12 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 23 inches thick. The substratum to a depth of 62 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more.

Permeability is moderate in the Woodcock soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include white fir, incense cedar, and sugar pine. The understory vegetation includes sierra chinkapin, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Pokegema soil and 110 on the Woodcock soil.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 105 on both the Pokegema and Woodcock soils. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on the unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, sedge, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production.

The vegetative site is Mixed Conifer-Chinkapin-Sedge Forest.

148C—Pokegema-Woodcock complex, warm, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 4,300 to 5,000 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 40 to 43 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 70 percent Pokegema soil and 20 percent Woodcock soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Merlin soils,

small areas of Rock outcrop, and small areas of Klamath and Kanutchan Variant soils near drainageways and on concave slopes. Also included are small areas of soils that are similar to the Pokegema soil but have bedrock at a depth of less than 40 or more than 60 inches, soils that are similar to the Woodcock soil but have bedrock within a depth of 60 inches, and Pokegema and Woodcock soils that have slopes of more than 12 percent. Included areas make up about 10 percent of the total acreage.

The Pokegema soil is deep and well drained. It formed in residuum derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is dark reddish brown loam about 8 inches thick. The upper 8 inches of the subsoil is dark reddish brown clay loam. The lower 22 inches is dark reddish brown gravelly clay. The substratum is dark reddish brown and reddish brown gravelly clay about 14 inches thick. Weathered bedrock is at a depth of about 52 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Pokegema soil. Available water capacity is about 66 inches. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

The Woodcock soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 4 inches thick. The next layer is dark reddish brown very gravelly loam about 12 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 23 inches thick. The substratum to a depth of 62 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more.

Permeability is moderate in the Woodcock soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include white fir, incense cedar, and sugar pine. The understory vegetation includes sierra chinkapin, antelope bitterbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Pokegema soil and 110 on the Woodcock soil.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 105 on both the Pokegema and Woodcock soils. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on the unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, sedge, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical

treatment. Seeding disturbed areas to suitable plants increases forage production.

The vegetative site is Mixed Conifer-Bitterbrush-Sedge Forest.

149B—Pollard loam, 2 to 7 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark brown loam about 11 inches thick. The upper 25 inches of the subsoil is dark reddish brown clay loam. The lower 25 inches is yellowish red and brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam or gravelly loam.

Included in this unit are small areas of Abegg, Josephine, and Wolfpeak soils; poorly drained soils near drainageways and on concave slopes; and Pollard soils that have slopes of more than 7 percent. Included areas make up about 15 percent of the total acreage.

Permeability is slow in the Pollard soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for timber production, hay and pasture, or wildlife habitat. It also is used for homesite development.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are compaction and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability. In summer, irrigation is needed for the maximum production of most crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. The

main limitations are the moderately slow permeability and the shrink-swell potential. The moderately slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Douglas Fir-Black Oak Forest.

149D—Pollard loam, 7 to 20 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark brown loam about 11 inches thick. The upper 25 inches of the subsoil is dark reddish brown clay loam. The lower 25 inches is yellowish red and brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam or gravelly loam.

Included in this unit are small areas of Abegg, Josephine, Speaker, and Wolfpeak soils; poorly drained soils near drainageways and on concave slopes; and Pollard soils that have slopes of less than 7 or more than 20 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Pollard soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used mainly for timber production, hay and pasture, or wildlife habitat. It also is used for homesite development.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are compaction, erosion, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

This unit is well suited to irrigated crops. It is limited mainly by the slope, the hazard of erosion, and the moderately slow permeability. In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet.

Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the moderately slow permeability, the shrink-swell potential, and the slope. The moderately slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Douglas Fir-Black Oak Forest.

150E—Provig very gravelly loam, 15 to 35 percent slopes. This very deep, well drained soil is on fan terrace scarps. It formed in alluvium derived from mixed sources. Elevation is 1,100 to 1,500 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown and very dark grayish brown very gravelly loam about 9 inches thick. The subsoil is dark brown very gravelly clay loam about 6 inches thick. The substratum to a depth of 60 inches is dark reddish brown and reddish brown, stratified extremely gravelly clay. In some areas the surface layer is very cobbly.

Included in this unit are small areas of Carney soils, Agate and Winlo soils on the shoulders of hillslopes, and soils that are similar to the Provig soil but have sandstone bedrock at a depth of 40 to 60 inches. Also included are small areas of Provig soils that have slopes of less than 15 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is slow in the Provig soil. Available water capacity is about 4 inches. The effective rooting depth is 14 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for livestock grazing or homesite development.

The main limitations affecting livestock grazing are compaction, the slope, the very gravelly surface layer, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. In places the use of ground equipment is limited by the gravel and cobbles on the surface and by the slope.

Range seeding is suitable if the site is in poor condition. The main limitations affecting seeding are droughtiness and the slope. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope.

The main limitations affecting homesite development are the slow permeability, the slope, a high shrink-swell potential, and the very gravelly surface layer.

This unit is poorly suited to standard systems of waste disposal because of the slow permeability and the slope. Alternative waste disposal systems may function properly on this unit. Suitable included soils are in some areas of the unit. Onsite investigation is needed to locate such soils.

The slope limits the use of the steeper areas of this unit for building site development. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low

shrink-swell potential help to prevent the structural damage caused by shrinking and swelling.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Establishing plants is difficult in areas where the surface layer has been removed. Mulching and applying fertilizer help to establish plants in cut areas. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

151C—Provig-Agate complex, 5 to 15 percent slopes. This map unit is on fan terraces. Elevation is 1,100 to 1,850 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation on the Provig soil is mainly hardwoods and an understory of grasses, shrubs, and forbs. That on the Agate soil is mainly grasses, shrubs, and forbs.

This unit is about 60 percent Provig soil and 30 percent Agate soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Carney and Winlo soils, Cove and Padigan soils near drainageways and on concave slopes, and soils that are similar to the Provig soil but have sandstone bedrock at a depth of 40 to 60 inches. Also included are small areas of Provig and Agate soils that have slopes of less than 5 or more than 15 percent. Included areas make up about 10 percent of the total acreage.

The Provig soil is very deep and well drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is very dark brown and very dark grayish brown very gravelly loam about 9 inches thick. The subsoil is dark brown very gravelly clay loam about 6 inches thick. The substratum to a depth of 60 inches is dark reddish brown and reddish brown, stratified extremely gravelly clay. In some areas the surface layer is very cobbly.

Permeability is slow in the Provig soil. Available water capacity is about 4 inches. The effective rooting depth is 14 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Agate soil is moderately deep to a hardpan and is well drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is dark brown loam about 6 inches thick. The next layer is dark yellowish brown clay loam about 6 inches thick. The upper 13 inches of the subsoil is dark brown clay loam. The lower 5 inches is a hardpan. The substratum to a depth of 62 inches is light olive brown extremely gravelly coarse sandy loam. Depth to the hardpan is 20 to 30 inches. The depth to bedrock is 60 inches or more. In some areas the surface layer is gravelly or cobbly.

Permeability is moderately slow in the Agate soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 30 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for hay and pasture, homesite development, and livestock grazing.

The main limitations affecting the use of this unit for hay and pasture are compaction, droughtiness, the limited rooting depth, and the very gravelly surface layer of the Provig soil. In some areas ripping and shattering the hardpan in the Agate soil can increase the effective rooting depth.

If the pasture or range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

The native vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, pine bluegrass, and Lemmon needlegrass. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitation is droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both. In places the use of ground equipment is limited by the gravel on the surface of the Provig soil and the included Winlo soils.

In summer, irrigation is needed for the maximum production of hay and pasture. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water

should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the slow permeability, a high shrink-swell potential, the very gravelly surface layer in the Provig soil, and depth to the hardpan in the Agate soil.

This unit is poorly suited to standard systems of waste disposal because of depth to the hardpan in the Agate soil and the slow permeability in the Provig soil. The suitability of the Agate soil for septic tank absorption fields can be improved by ripping the hardpan. Alternative waste disposal systems may function properly on this unit. Suitable included soils are in some areas of the unit. Onsite investigation is needed to locate such soils.

If buildings are constructed on the Provig soil, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling.

Cuts needed to provide essentially level building sites can expose bedrock. Establishing plants is difficult in areas where the surface layer has been removed. Mulching and applying fertilizer help to establish plants in cut areas. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site in areas of the Provig soil is Loamy Hills, 20- to 35-inch precipitation zone, and the one in areas of the Agate soil is Biscuit-Scabland (mound), 18- to 26-inch precipitation zone.

152B—Randcore-Shoat complex, 0 to 5 percent slopes. This map unit is on plateaus. Elevation is 2,000 to 3,800 feet. The mean annual precipitation is 18 to 25 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 60 percent Randcore soil and 30 percent Shoat soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used. The soils occur as patterned land. Areas of the Randcore soil are between and around areas of the Shoat soil, which is on circular mounds (fig. 10).

Included in this unit are small areas of Lorella, Paragon, and Skookum soils; Rock outcrop; and soils that are similar to the Shoat soil but have bedrock at a depth of 10 to 20 inches or more than 40 inches. Also included are small areas of Randcore and Shoat soils that have slopes of more than 5 percent. Included areas make up about 10 percent of the total acreage.

The Randcore soil is very shallow and moderately well drained. It formed in loess over andesite. Typically, the surface layer is dark brown extremely stony loam about 1 inch thick. The next layer is dark brown loam about 5 inches thick. Bedrock is at a depth of about 6 inches. The depth to bedrock ranges from 4 to 10 inches.

Permeability is moderate in the Randcore soil. Available water capacity is about 1 inch. The effective rooting depth is 4 to 10 inches. This soil is ponded in January and February. Runoff is ponded, and the hazard of water erosion is slight.

The Shoat soil is moderately deep and well drained. It formed in loess over andesite. Typically, the surface layer is dark brown loam about 4 inches thick. The subsoil also is dark brown loam. It is about 20 inches thick. Bedrock is at a depth of about 24 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Shoat soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction and droughtiness in summer and fall. The Randcore soil also is limited by stones on the surface, wetness in winter and spring, and the depth to bedrock. The vegetation suitable for grazing includes bluebunch wheatgrass, Idaho fescue, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment generally is not practical because of the stones on the surface of the Randcore soil.

This unit is poorly suited to range seeding. The main

Figure 10.—An area of Randcore-Shoat complex, 0 to 5 percent slopes, which occurs as patterned land.

limitations in areas of the Randcore soil are the depth to bedrock, the stones on the surface, wetness in winter and spring, and droughtiness in summer and fall. The main limitation affecting seeding on the Shoat soil is droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The vegetative site in areas of the Randcore soil is Biscuit-Scabland (intermound), 18- to 26-inch precipitation zone, and the one in areas of the Shoat soil is Biscuit-Scabland (mound), 18- to 26-inch precipitation zone.

153B—Reinecke-Coyata complex, 0 to 5 percent slopes. This map unit is on plateaus. Elevation is 2,600 to 3,800 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Reinecke soil and 30 percent Coyata soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used. The Coyata soil commonly is on the more sloping parts of the landscape.

Included in this unit are small areas of Alcot, Crater Lake, and Dumont soils; soils that are similar to the

Reinecke soil but are overlain by less than 20 inches of ash; and soils that are similar to the Coyata soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Reinecke and Coyata soils that have slopes of more than 5 percent. Included areas make up about 15 percent of the total acreage.

The Reinecke soil is very deep and well drained. It formed in volcanic ash over residuum derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is dark brown sandy loam about 9 inches thick. The subsoil is brown gravelly sandy loam about 16 inches thick. It is underlain by a buried soil. The upper 8 inches of the buried soil is dark reddish brown loam. The lower 27 inches is dark reddish brown cobbly loam. The depth to bedrock is 60 inches or more.

Permeability is moderate in the Reinecke soil. Available water capacity is about 12 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145 on the Reinecke soil. The yield at culmination of the mean annual increment is 9,120 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 74,360 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 110.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Coyata soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are compaction, plant competition, and seedling mortality. Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Because of the high content of volcanic ash in the Reinecke soil, displacement of the surface layer occurs most readily during dry periods. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Logging roads require suitable surfacing for year-round use. Construction and maintenance of roads built on the Reinecke soil may be difficult because of the volcanic ash, which is poor subgrade material because it is not easily compacted when dry, has a moderate potential for frost action, and has a high water-holding capacity. When wet or moist, unsurfaced roads and skid trails are soft. They may be impassable during rainy periods. When dry, they are very dusty.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The Reinecke soil also is limited by soil displacement. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the

understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock. Displacement of the surface layer occurs most readily when the soils are dry.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling mortality rate may be increased if the Reinecke soil is grazed when it is susceptible to displacement.

The vegetative site is Mixed Fir-Western Hemlock Forest.

154—Riverwash. This map unit consists of deep, excessively drained to very poorly drained, recently deposited alluvium in narrow, irregular strips along the major streams and rivers. Slope is 0 to 3 percent. Riverwash supports little, if any, vegetation. Elevation is 1,000 to 2,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 140 to 180 days.

Most areas of Riverwash are very cobbly, extremely cobbly, or extremely gravelly sand to a depth of 60 inches or more.

Included in this unit are small areas of Camas, Evans, and Newberg soils on flood plains and Takilma soils on terraces. Also included are small areas of Dumps and Xerorthents.

Permeability is very rapid in the areas of Riverwash. Available water capacity is low. Runoff is slow, and the hazard of water erosion is slight to severe. This unit is subject to flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

This unit is used mainly for wildlife habitat. A few areas are used as a source of sand and gravel. Because it is frequently flooded, the unit is unsuited to most other uses.

This unit is not assigned to a vegetative site.

155E—Rogue cobbly coarse sandy loam, 12 to 35 percent north slopes. This deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived dominantly from granitic rock. Elevation is 3,600 to 6,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown cobbly coarse sandy loam about 6 inches thick. The subsoil is brown and yellowish brown cobbly coarse sandy loam about 28 inches thick. The substratum is light olive brown and light yellowish brown coarse sandy loam about 20 inches thick. Weathered bedrock is at a depth of about 54 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony or very cobbly.

Included in this unit are small areas of poorly drained soils near drainageways and on concave slopes and soils that are similar to the Rogue soil but have more than 35 percent rock fragments or have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Rogue soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Rogue soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar, and ponderosa pine. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and whitevein shinleaf.

On the basis of a 50-year site curve, the mean site index for white fir is 80. The yield at culmination of the mean annual increment is 13,720 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and

landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and white fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Oceanspray Forest.

155G—Rogue cobbly coarse sandy loam, 35 to 80 percent north slopes. This deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived dominantly from granitic rock. Elevation is 3,600 to 6,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown cobbly coarse sandy loam about 6 inches thick. The subsoil is brown and yellowish brown cobbly coarse sandy loam about 28 inches thick. The substratum is light olive brown and light yellowish brown coarse sandy loam about 20 inches thick. Weathered bedrock is at a depth of about 54 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony or very cobbly.

Included in this unit are small areas of poorly drained soils near drainageways and soils that are similar to the Rogue soil but have more than 35 percent rock fragments or have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Rogue soils that have slopes of less than 35 or more than 80 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Rogue soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar, and ponderosa pine. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and whitevein shinleaf.

On the basis of a 50-year site curve, the mean site index for white fir is 80. The yield at culmination of the mean annual increment is 13,720 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and

seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and white fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Oceanspray Forest.

156E—Rogue cobbly coarse sandy loam, 12 to 35 percent south slopes. This deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived dominantly from granitic rock. Elevation is 3,600 to 6,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown cobbly coarse sandy loam about 6 inches thick. The subsoil is brown and yellowish brown cobbly coarse sandy loam about 28 inches thick. The substratum is light olive brown and light yellowish brown coarse sandy loam about 20 inches thick. Weathered bedrock is at a depth of about 54 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony or very cobbly.

Included in this unit are small areas of poorly drained soils near drainageways and on concave slopes and

soils that are similar to the Rogue soil but have more than 35 percent rock fragments or have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Rogue soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Rogue soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and Douglas fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 50-year site curve, the mean site index for white fir is 70. The yield at culmination of the mean annual increment is 11,410 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface.

Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by

prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

156G—Rogue cobbly coarse sandy loam, 35 to 75 percent south slopes. This deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived dominantly from granitic rock. Elevation is 3,600 to 6,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown cobbly coarse sandy loam about 6 inches thick. The subsoil is brown and yellowish brown cobbly coarse sandy loam about 28 inches thick. The substratum is light olive brown and light yellowish brown coarse sandy loam about 20 inches thick. Weathered bedrock is at a depth of about 54 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony or very cobbly.

Included in this unit are small areas of poorly drained soils near drainageways and soils that are similar to the Rogue soil but have more than 35 percent rock fragments or have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Rogue soils that have slopes of less than 35 or more than 75 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Rogue soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and Douglas fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 50-year site curve, the mean site index for white fir is 70. The yield at culmination of the mean annual increment is 11,410 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface.

Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is

harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

157B—Ruch silt loam, 2 to 7 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The upper 10 inches of the subsoil is reddish brown loam. The lower 53 inches is yellowish red loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is gravelly, cobbly, or stony.

Included in this unit are small areas of Camas, Evans, and Newberg soils on flood plains; Gregory soils near drainageways; Selmac soils on concave slopes; Coleman, Foehlin, and Medford soils on terraces; and Abegg, Manita, Shefflein, and Vannoy soils. Also included are small areas of Xerorthents, small areas of Dumps, and small areas of Ruch soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Ruch soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for irrigated crops, such as alfalfa hay, small grain, and tree fruit. Other crops include corn for silage and grass-legume hay. Some areas are used for timber production, pasture, or homesite development.

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to homesite development. It has few limitations. Revegetating as soon as possible in disturbed areas around construction sites helps to control erosion. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,780 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

158B—Ruch gravelly silt loam, 2 to 7 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown gravelly silt loam about 7 inches thick. The upper 10 inches of the subsoil is reddish brown loam. The lower 53 inches is yellowish red loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Camas, Evans, and Newberg soils on flood plains; Gregory soils near drainageways; Selmac soils on concave slopes; Coleman, Foehlin, and Medford soils on terraces; and Abegg, Manita, Shefflein, and Vannoy soils. Also included are small areas of Xerorthents, small areas of Dumps, and small areas of Ruch soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Ruch soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for irrigated crops, such as alfalfa hay, small grain, and tree fruit. Other crops include corn for silage and grass-legume hay. Some areas are used for timber production, pasture, or homesite development.

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability and the gravelly surface layer, which may limit the use of some equipment and increase maintenance costs. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used

generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to homesite development. It has few limitations. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,780 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface.

Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in some areas also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

158D—Ruch gravelly silt loam, 7 to 20 percent slopes. This very deep, well drained soil is on alluvial fans and foot slopes. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 50 to 54

degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown gravelly silt loam about 7 inches thick. The upper 10 inches of the subsoil is reddish brown loam. The lower 53 inches is yellowish red loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Gregory soils near drainageways; Selmac soils on concave slopes; Vannoy and Voorhies soils on ridges and convex slopes; Coleman, Foehlin, and Medford soils on terraces; and Abegg, Manita, and Shefflein soils. Also included are small areas of Xerorthents, small areas of Dumps, and small areas of Ruch soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Ruch soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used mainly for irrigated crops, such as alfalfa hay, small grain, tree fruit, and grass-legume hay. It also is used for timber production, pasture, and homesite development.

This unit is suited to irrigated crops. It is limited mainly by the slope, the moderately slow permeability, and the gravelly surface layer, which may limit the use of some equipment and increase maintenance costs. In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler and trickle irrigation systems are the best methods of applying water. These systems permit an even, controlled application of water, help to prevent excessive runoff, and minimize the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

The hazard of erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grasses.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

The main limitation affecting homesite development is the slope. Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,780 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively

disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in some areas also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

159C—Rustlerpeak gravelly loam, 3 to 12 percent slopes. This moderately deep, well drained soil is on plateaus. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,000 to 6,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 12 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Snowlin soils on concave slopes, poorly drained soils near drainageways and on concave slopes, Woodseye soils and Rock outcrop on convex slopes, and soils that are similar to the Rustlerpeak soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Rustlerpeak soils that have slopes of less than 3 or more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Rustlerpeak soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, western white anemone, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

160E—Rustlerpeak gravelly loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,000 to 6,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 12 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Snowlin soils on concave slopes, poorly drained soils near drainageways and on concave slopes, Woodseye soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Rustlerpeak soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Rustlerpeak soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Rustlerpeak soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, western white anemone, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps

to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

160G—Rustlerpeak gravelly loam, 35 to 65 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,000 to 6,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 12 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Snowlin soils on concave slopes and on the less sloping parts of the landscape, Woodseye soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Rustlerpeak soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Rustlerpeak soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Rustlerpeak soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, western white anemone, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris

can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Because of the slope and the Rock outcrop, areas of this unit can hinder livestock movement.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be limited, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

161G—Rustlerpeak-Rock outcrop complex, 35 to 70 percent north slopes. This map unit is on hillslopes. Elevation is 4,000 to 6,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 70 percent Rustlerpeak soil and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Snowlin soils on concave slopes and on the less sloping parts of the landscape, Woodseye soils on ridges and convex slopes, and soils that are similar to the Rustlerpeak soil but have bedrock at a depth of less than 20 or more than 40 inches. Also included are small areas of Rustlerpeak soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 10 percent of the total acreage.

The Rustlerpeak soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 12 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Rustlerpeak soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar, and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, western white anemone, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, the Rock outcrop, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. The Rock outcrop can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is

least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, the slope, and the Rock outcrop. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be limited, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

162B—Selmac loam, 2 to 7 percent slopes. This very deep, moderately well drained soil is in basins. It formed in alluvium derived dominantly from sedimentary and volcanic rock and underlain by clayey sediment. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 17 inches thick. The subsoil is reddish brown clay loam about 12 inches thick. The substratum to a depth of 60 inches is olive brown clay. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Darow, Manita, and Vannoy soils on hillslopes; Debenger and Ruch soils on convex slopes; Langellain soils; and Gregory soils and poorly drained or very poorly drained, loamy soils near drainageways and on concave slopes. Also included are small areas of Selmac soils that have slopes of more than 7 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow to a depth of 29 inches in the Selmac soil and very slow below that depth. Available water capacity is about 8 inches. The effective rooting depth is limited by the dense, clayey substratum, which is at a depth of 12 to 36 inches. Runoff is slow, and the hazard of water erosion is slight. The water table, which is perched above the layer of clay, is at a depth of 1.5 to 3.0 feet from December through May.

This unit is used mainly for hay and pasture. It also is used for small grain, tree fruit, and homesite development.

This unit is suited to irrigated crops. It is limited mainly by wetness in winter and spring and the very slow permeability. Crops that require good drainage can be grown if a properly designed tile drainage system is installed. Tile drainage can lower the water table if collection laterals are closely spaced and a suitable outlet is available. Land smoothing and open ditches can reduce surface wetness.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To

prevent overirrigation and the development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the wetness, the very slow permeability, a high shrink-swell potential, and low strength.

The very slow permeability and the seasonal high water table increase the possibility that septic tank absorption fields will fail. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Because the seasonal high water table is perched above the layer of clay, a drainage system is needed on sites for buildings with basements and crawl spaces. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

162D—Selmac loam, 7 to 20 percent slopes. This very deep, moderately well drained soil is in basins. It formed in alluvium derived dominantly from sedimentary and volcanic rock and underlain by clayey sediment. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 17 inches thick. The subsoil is reddish brown clay loam about 12 inches thick. The substratum to a depth of 60 inches is olive brown clay. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Darow, Manita, and Vannoy soils on hillslopes; Debenger and Ruch soils on convex slopes; Langellain soils; and Gregory soils and poorly drained or very poorly drained, loamy soils near drainageways and on concave slopes. Also included are small areas of Selmac soils that have slopes of less than 7 or more than 20 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow to a depth of 29 inches in the Selmac soil and very slow below that depth. Available water capacity is about 8 inches. The effective rooting depth is limited by the dense, clayey substratum, which is at a depth of 12 to 36 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table, which is perched above the layer of clay, is at a depth of 1.5 to 3.0 feet from December through May.

This unit is used mainly for hay and pasture. It also is used for tree fruit, small grain, and homesite development.

This unit is suited to irrigated crops. It is limited mainly by wetness in winter and spring, the very slow permeability, and the slope. Crops that require good drainage can be grown if a properly designed drainage system is installed. The ability of tile drains to remove subsurface water from the soil is limited because of the slope and the very slow permeability in the substratum. Wetness can be reduced by interceptor drains. Open ditches can reduce surface wetness.

In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

The hazard of erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grasses.

Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

The main limitations affecting homesite development are the wetness, the very slow permeability, a high shrink-swell potential, and the slope.

The very slow permeability and the seasonal high water table increase the possibility that septic tank absorption fields will fail. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Because the seasonal high water table is perched above the layer of clay, a drainage system is needed on sites for buildings with basements and crawl spaces. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

163A—Sevenoaks loamy sand, 0 to 3 percent slopes. This very deep, somewhat excessively drained soil is on stream terraces. It formed in alluvium derived from mixed sources and containing various amounts of pumice and volcanic ash. Elevation is 1,000 to 1,500 feet. The mean annual precipitation is 18 to 25 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown loamy sand about 14 inches thick. The next layer is dark brown gravelly sand about 8 inches thick. The substratum to a depth of 60 inches is dark grayish brown and olive brown gravelly coarse sand and gravelly sand. In some areas the surface layer is sandy loam.

Included in this unit are small areas of Central Point, Medford, and Takilma soils; Gregory soils on concave slopes; and Sevenoaks soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Sevenoaks soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. The substratum can restrict the penetration of roots, however, because of droughtiness. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated crops, such as alfalfa hay, tree fruit, and small grain. Other crops

include corn for silage. Some areas are used for grass hay, pasture, or homesite development.

This unit is suited to irrigated crops. It is limited mainly by a rapid rate of water intake and droughtiness. In summer, irrigation is needed for the maximum production of most crops. Because the rate of water intake is rapid, sprinkler and trickle irrigation systems are the best methods of applying water. These systems permit an even, controlled application of water, help to prevent excessive runoff, and minimize the risk of erosion. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control soil blowing.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet and by planting a cover crop. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is suited to homesite development. The main limitations are the moderately rapid permeability and droughtiness.

This unit is poorly suited to standard systems of waste disposal because of the moderately rapid permeability. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating as soon as possible in disturbed areas around construction sites helps to control soil blowing. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls.

Establishing plants is difficult in areas where the surface layer has been removed. Mulching and applying fertilizer help to establish plants in cut areas. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

164B—Shefflein loam, 2 to 7 percent slopes. This deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from granitic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 4 inches thick. The next layer is reddish brown loam about 6 inches thick. The upper 30 inches of the subsoil is reddish brown clay loam. The lower 16 inches is reddish brown sandy clay loam. Weathered bedrock is at a depth of about 56 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is sandy loam or clay loam.

Included in this unit are small areas of Clawson and Kubli soils near drainageways and on concave slopes; Barron, Manita, and Ruch soils; and soils that are similar to the Shefflein soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Shefflein soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Shefflein soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is moderate.

This unit is used mainly for hay and pasture, timber production, or wildlife habitat. It also is used for homesite development.

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability and the hazard of erosion. In summer, irrigation is needed for the maximum production of most crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive

erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. The main limitations are the moderately slow permeability and the shrink-swell potential. The moderately slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,780 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

164D—Shefflein loam, 7 to 20 percent slopes. This deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from granitic rock.

Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 4 inches thick. The next layer is reddish brown loam about 6 inches thick. The upper 30 inches of the subsoil is reddish brown clay loam. The lower 16 inches is reddish brown sandy clay loam. Weathered bedrock is at a depth of about 56 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is sandy loam or clay loam or is stony.

Included in this unit are small areas of Clawson and Kubli soils near drainageways and on concave slopes; Tallowbox soils on the more sloping parts of the landscape; Barron, Manita, and Ruch soils; and soils that are similar to the Shefflein soil but have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Shefflein soils that have slopes of less than 7 or more than 20 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Shefflein soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for timber production or wildlife habitat. It also is used for hay and pasture and for homesite development.

This unit is suited to irrigated crops. It is limited mainly by the slope, the hazard of erosion, and the moderately slow permeability. In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the moderately slow permeability, the shrink-swell potential, and the slope. The moderately slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,780 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist

when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

165E—Shefflein loam, 20 to 35 percent north slopes. This deep, well drained soil is on hillslopes. It formed in colluvium and residuum derived from granitic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 4 inches thick. The next layer is reddish brown loam about 6 inches thick. The upper 30 inches of the subsoil is reddish brown clay loam. The lower 16 inches is reddish brown sandy clay loam. Weathered bedrock is at a depth of about 56 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is sandy loam or clay loam.

Included in this unit are small areas of Ruch, Vannoy, and Voorhies soils; Tallowbox soils on the more sloping parts of the landscape and on convex slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Shefflein soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Shefflein soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Shefflein soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 80.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,780 board feet per acre (Scribner rule) at 110 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded

Figure 11.—Severely eroded roadcut in an area of Shefflein loam, 20 to 35 percent north slopes.

unless they are treated (fig. 11). Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

166E—Shefflein loam, 20 to 35 percent south slopes. This deep, well drained soil is on hillslopes. It formed in colluvium and residuum derived from granitic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 4 inches thick. The next layer is reddish brown loam about 6 inches thick. The upper 30 inches of the subsoil is reddish brown clay loam. The lower 16 inches is reddish brown sandy clay loam. Weathered bedrock is at a depth of about 56 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is sandy loam or clay loam or is stony.

Included in this unit are small areas of Ruch, Vannoy, and Voorhies soils; Tallowbox soils on the more sloping parts of the landscape and on convex slopes; and soils that are similar to the Shefflein soil but have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of poorly drained soils near drainageways and on concave slopes and Shefflein soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Shefflein soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and Idaho fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 100. The yield at culmination of the mean annual increment is 4,080 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 44,640 board feet per acre (Scribner rule) at 120 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied (fig. 12). Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

Figure 12.—Competing plants in a burned area of Shefflein loam, 20 to 35 percent south slopes. Whiteleaf manzanita is in the foreground.

The vegetative site is Mixed Pine-Douglas Fir-Fescue Forest, Granitic.

167B—Sibannac silt loam, 0 to 7 percent slopes. This very deep, poorly drained soil is in basins. It formed in alluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,600 to 5,800 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is black silt loam about 6 inches thick. The next layer is black silty clay loam about 5 inches thick. The subsoil is very dark gray and very dark grayish brown clay loam about 21 inches thick. The substratum to a depth of 60 inches is very dark grayish brown and black clay loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Bybee, Farva, Kanutchan, Pinehurst, Rustlerpeak, Snowlin, and Tatouche soils; very poorly drained, organic soils; and Sibannac soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Sibannac soil. Available water capacity is about 12 inches. The

effective rooting depth is limited by the water table, which is within a depth of 1 foot from January through June. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for pasture and wildlife habitat. The main limitations affecting livestock grazing are the seasonal wetness and compaction. The wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill.

If the pasture is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

Tufted hairgrass is the native plant preferred for livestock grazing; however, this unit can be renovated and forage production increased by seeding other suitable grasses. The plants selected for seeding should be those that are tolerant of a cold climate and wetness. Fertilizer is needed to ensure the optimum growth of grasses. Grasses respond to nitrogen.

The vegetative site is Wet Meadow.

168G—Siskiyou gravelly sandy loam, 35 to 60 percent north slopes. This moderately deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark brown gravelly sandy loam about 9 inches thick. The subsoil is olive brown sandy loam about 8 inches thick. The substratum is grayish brown sandy loam about 18 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Beekman, Colestine, Josephine, and Speaker soils; Rock outcrop; soils that are similar to the Siskiyou soil but have bedrock at a depth of more than 40 inches; and, on ridges, soils that are similar to the Siskiyou soil but have bedrock at a depth of less than 20 inches. Also included are small areas of Siskiyou soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Siskiyou soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and Pacific dogwood. The understory vegetation includes creambush oceanspray, California hazel, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 15,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can

result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Dogwood Forest, Granitic.

169G—Siskiyou gravelly sandy loam, 35 to 60 percent south slopes. This moderately deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark brown gravelly sandy loam about 9 inches thick. The subsoil is olive brown sandy loam about 8 inches thick. The substratum is grayish brown sandy loam about 18 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Beekman, Colestine, Josephine, and Speaker soils; Rock outcrop; soils that are similar to the Siskiyou soil but have bedrock at a depth of more than 40 inches; and, on ridges, soils that are similar to the Siskiyou soil but have bedrock within a depth of 20 inches. Also included are small areas of Siskiyou soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Siskiyou soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can

result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Black Oak Forest.

170C—Skookum very cobbly loam, 1 to 12 percent slopes. This moderately deep, well drained soil is on hillslopes. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly grasses, shrubs, and forbs and a few scattered hardwoods.

Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Lorella, McMullin, Randcore, and Shoat soils; Carney and Medco soils on concave slopes; McNull soils on north-facing slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Skookum soils that have slopes of more than 12 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction, cobbles and stones on the surface, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is limited in many areas by the cobbles and stones on the surface.

Range seeding is suitable if the site is in poor condition. The main limitations are droughtiness and the cobbles and stones on the surface. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Droughty Slopes, 20- to 30-inch precipitation zone.

171E—Skookum-Bogus complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 3,000 to 4,400 feet. The mean annual precipitation is 18 to 25 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation on the Skookum soil is mainly grasses, shrubs, and forbs and a few scattered hardwoods. That on the Bogus soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Skookum soil and 30 percent Bogus soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Heppsie soils,

Lorella soils and Rock outcrop on convex slopes, Carney soils on concave slopes, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of soils that are similar to the Bogus soil but have bedrock within a depth of 60 inches, soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches, and Bogus and Skookum soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Skookum soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Bogus soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is black very gravelly loam about 7 inches thick. The next layer is very dark grayish brown very gravelly loam about 8 inches thick. The upper 6 inches of the subsoil is dark brown gravelly clay loam. The lower 44 inches is dark yellowish brown and dark brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is slow in the Bogus soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for livestock grazing or wildlife habitat. The Bogus soil also is used for timber production.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The Skookum soil also is limited by cobbles and stones on the surface and by droughtiness. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass on the Skookum soil and western fescue, mountain brome, and tall trisetum on the Bogus soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is limited by the cobbles and stones on the surface of the Skookum soil and the slope.

This unit is poorly suited to range seeding. The main limitations are droughtiness and the cobbles and stones on the surface of the Skookum soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope of both soils and the depth to bedrock in the Skookum soil.

The Bogus soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and California black oak. The understory vegetation includes tall Oregon grape, common snowberry, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Bogus soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90 on the Bogus soil. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production on the Bogus soil are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid

trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in some areas also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site in areas of the Skookum soil is Droughty Slopes, 20- to 30-inch precipitation zone, and the one in areas of the Bogus soil is Douglas Fir-Mixed Pine-Sedge Forest.

172E—Skookum-Bogus complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 3,000 to 4,400 feet. The mean annual precipitation is 18 to 25 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation on the Skookum soil is mainly grasses, shrubs, and forbs and a few scattered hardwoods. That on the Bogus soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Skookum soil and 25 percent Bogus soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Heppsie soils, Lorella soils and Rock outcrop on convex slopes, Carney soils on concave slopes, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of soils that are similar to the Bogus soil but have bedrock within a depth of 60 inches, soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches, and Bogus and Skookum soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Skookum soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Bogus soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is black very gravelly loam about 7 inches thick. The next layer is very dark grayish brown very gravelly loam about 8 inches thick. The upper 6 inches of the subsoil is dark brown gravelly clay loam. The lower 44 inches is dark yellowish brown and dark brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is slow in the Bogus soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for livestock grazing or wildlife habitat. The Bogus soil also is used for timber production.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The Skookum soil also is limited by cobbles and stones on the surface and by droughtiness. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass on the Skookum soil and western fescue, mountain brome, and tall trisetum on the Bogus soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure

and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment on the Skookum soil is limited by the cobbles and stones on the surface and the slope.

This unit is poorly suited to range seeding. The main limitations are droughtiness and the cobbles and stones on the surface of the Skookum soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope of both soils and the depth to bedrock in the Skookum soil.

The Bogus soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and California black oak. The understory vegetation includes tall Oregon grape, common snowberry, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90 on the Bogus soil. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 85 on the Bogus soil. The yield at culmination of the mean annual increment is 3,080 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 38,700 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production on the Bogus soil are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in some areas also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site in areas of the Skookum soil is Droughty Slopes, 20- to 30-inch precipitation zone, and the one in areas of the Bogus soil is Douglas Fir-Mixed Pine-Sedge Forest.

173D—Skookum-Rock outcrop-McMullin complex, 1 to 20 percent slopes. This map unit is on plateaus. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly grasses, shrubs, and forbs and a few scattered hardwoods.

This unit is about 60 percent Skookum soil, 15 percent Rock outcrop, and 15 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Lorella, Randcore, and Shoat soils; Carney and Medco soils on concave slopes; McNull soils on north-facing slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Skookum and McMullin

soils that have slopes of more than 20 percent. Included areas make up about 10 percent of the total acreage.

The Skookum soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction, erosion, the Rock outcrop, cobbles and stones on the surface, and droughtiness. The McMullin soil also is limited by the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the cobbles and stones on the surface and the Rock outcrop.

This unit is poorly suited to range seeding. The main limitations are the depth to bedrock in the McMullin soil, droughtiness, the cobbles and stones on the surface, and the Rock outcrop. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the Skookum soil is Droughty Slopes, 20- to 30-inch precipitation zone, and the one in areas of the McMullin soil is Loamy Shrub Scabland, 18- to 35-inch precipitation zone.

173F—Skookum-Rock outcrop-McMullin complex, 20 to 50 percent slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,700 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly grasses, shrubs, and forbs and a few scattered hardwoods.

This unit is about 55 percent Skookum soil, 20 percent Rock outcrop, and 15 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Heppsie and Lorella soils, Carney and Medco soils on concave slopes, McNull soils on north-facing slopes, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches, soils that are similar to the McMullin soil but have bedrock at a depth of less than 12 or more than 20 inches, and Skookum and McMullin soils that have slopes of less than 20 or more than 50 percent. Included areas make up about 10 percent of the total acreage.

The Skookum soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are the slope, erosion, compaction, the Rock outcrop, cobbles and stones on the surface, and droughtiness. The McMullin soil also is limited by the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the cobbles and stones on the surface, the Rock outcrop, and the slope.

This unit is poorly suited to range seeding. The main limitations are the slope, droughtiness, the Rock outcrop, the cobbles and stones on the surface, and the depth to bedrock in the McMullin soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The slope and the Rock outcrop limit access by livestock. As a result, the less sloping areas tend to be overgrazed. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the Skookum soil is Droughty Slopes, 20- to 30-inch precipitation zone, and the one in areas of the McMullin soil is Loamy Shrub Scabland, 18- to 35-inch precipitation zone.

174G—Skookum-Rock outcrop-Rubble land complex, 35 to 70 percent slopes. This map unit is on hillslopes (fig. 13). Elevation is 2,800 to 4,800 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly grasses, shrubs, and forbs and a few scattered hardwoods.

This unit is about 40 percent Skookum soil, 20 percent Rock outcrop, and 10 percent Rubble land. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Heppsie and Lorella soils, Carney soils on concave slopes, Bogus and McNull soils on north-facing slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches. Also included are small areas where slopes are less than 35 or more than 70 percent. Included areas make up about 30 percent of the total acreage.

The Skookum soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Rubble land consists of areas of stones and boulders. Runoff is very rapid in areas of both the Rock outcrop and the Rubble land.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are the slope, erosion, compaction, the Rock outcrop and Rubble land, cobbles and stones on the surface, and droughtiness. Because of the slope, the Rock outcrop, and the Rubble land, areas of this unit can hinder livestock movement. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable

Figure 13.—Typical area of Skookum-Rock outcrop-Rubble land complex, 35 to 70 percent slopes.

forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the cobbles and stones on the surface, the Rock outcrop, the Rubble land, and the slope.

This unit is poorly suited to range seeding. The main limitations are the slope, droughtiness, the cobbles and stones on the surface, and the Rock outcrop and Rubble land. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The slope and the Rock outcrop and Rubble land limit access by livestock. As a result, the less sloping areas tend to be overgrazed. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Droughty Slopes, 20- to 30-inch precipitation zone.

175F—Snowbrier gravelly loam, 25 to 50 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from schist. Elevation is 3,600 to 4,700 feet. The mean annual precipitation is 40 to 60 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark brown gravelly loam about 5 inches thick. The next layer is very dark grayish brown gravelly loam about 7 inches thick. The upper 10 inches of the subsoil is dark grayish brown very gravelly loam. The lower 17 inches is olive very cobbly loam. Bedrock is at a depth of about 39 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly or stony.

Included in this unit are small areas of Acker and Norling soils and soils that are similar to the Snowbrier soil but have less than 35 percent rock fragments or have bedrock at a depth of more than 40 inches. Also included are small areas of Snowbrier soils that have slopes of less than 25 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Snowbrier soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar, golden chinkapin, and western hemlock. The understory vegetation includes Pacific rhododendron, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Mixed Fir-Salal (rhododendron) Forest.

176F—Snowbrier gravelly loam, 25 to 50 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from schist. Elevation is 3,600 to 4,700 feet. The mean annual precipitation is 40 to 60 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark brown gravelly loam about 5 inches thick. The next layer is very dark grayish brown gravelly loam about 7 inches thick. The upper 10 inches of the subsoil is dark grayish brown very gravelly loam. The lower 17 inches is olive very cobbly loam. Bedrock is at a depth of about 39 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly or stony.

Included in this unit are small areas of Acker and Norling soils and soils that are similar to the Snowbrier soil but have less than 35 percent rock fragments or have bedrock at a depth of more than 40 inches. Also included are small areas of Snowbrier soils that have slopes of less than 25 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Snowbrier soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes golden chinkapin, cascade Oregongrape, and Whipplevine.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Madrone-Chinkapin Forest.

177C—Snowlin gravelly loam, 3 to 12 percent slopes. This very deep, well drained soil is on plateaus. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,000 to 6,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is dark reddish brown gravelly loam about 20 inches thick. The upper 14 inches of the subsoil is dark reddish brown gravelly clay loam. The lower 26 inches is dark reddish brown very gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Included in this unit are small areas of poorly drained soils near drainageways and on concave slopes, Rustlerpeak soils on convex slopes and on the more sloping parts of the landscape, and soils that are similar to the Snowlin soil but have bedrock within a depth of 60 inches. Also included are small areas of Snowlin soils that have slopes of less than 3 or more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Snowlin soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar, and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, western white anemone, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 80. The yield at culmination of the mean annual increment is 13,720 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be limited, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

178E—Snowlin gravelly loam, 12 to 35 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,000 to 6,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The

native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is dark reddish brown gravelly loam about 20 inches thick. The upper 14 inches of the subsoil is dark reddish brown gravelly clay loam. The lower 26 inches is dark reddish brown very gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Included in this unit are small areas of poorly drained soils near drainageways and on concave slopes, Rustlerpeak soils on convex slopes and on the more sloping parts of the landscape, and soils that are similar to the Snowlin soil but have bedrock within a depth of 60 inches. Also included are small areas of Snowlin soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Snowlin soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar, and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, western white anemone, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 80. The yield at culmination of the mean annual increment is 13,720 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be limited, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

179F—Speaker-Josephine complex, 35 to 55 percent south slopes. This map unit is on hillslopes. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Speaker soil and 40 percent Josephine soil. The components of this unit occur as areas so intricately intermingled that mapping

them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Goolaway, Pearsoll, and Siskiyou soils; Pollard, Beekman, and McMullin soils on the less sloping parts of the landscape and on concave slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Speaker and Josephine soils but have more than 35 percent rock fragments. Also included are small areas of Speaker and Josephine soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 15 percent of the total acreage.

The Speaker soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown loam about 13 inches thick. The upper 10 inches of the subsoil also is dark brown loam. The lower 12 inches is brown gravelly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability is moderately slow in the Speaker soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Josephine soil is deep and well drained. It formed in colluvium and residuum derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 15 inches thick. The subsoil is dark reddish brown and reddish brown gravelly clay loam about 40 inches thick. Weathered bedrock is at a depth of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Permeability is moderately slow in the Josephine soil. Available water capacity is about 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include sugar pine and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115 on the Speaker soil. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 105 on the Speaker soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Josephine soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115 on the Josephine soil. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,780 board feet per acre (Scribner rule) at 110 years.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be

impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site is Douglas Fir-Black Oak Forest.

180G—Steinmetz sandy loam, 35 to 75 percent north slopes. This very deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark grayish brown and brown sandy loam about 13 inches thick. The subsoil to a depth of 60 inches is dark yellowish brown and brown sandy loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Dubakella, Goolaway, Gravecreek, Musty, and Rogue soils; Rock outcrop; Atring and Kanid soils on the more sloping parts of the landscape; Lettia soils on the less sloping parts of the landscape and on concave slopes; and soils that are similar to the Steinmetz soil but that have bedrock within a depth of 60 inches. Also included are small areas of Steinmetz soils that have slopes of less than 35 or more than 75 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Steinmetz soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, western hemlock, and Pacific madrone. The understory vegetation includes golden chinkapin, salal, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 110.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can

be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Mixed Fir-Salal (rhododendron) Forest.

181G—Steinmetz sandy loam, 35 to 75 percent south slopes. This very deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark grayish brown and brown sandy loam about 13 inches thick. The subsoil to a depth of 60 inches is dark yellowish brown and brown sandy loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Dubakella, Goolaway, Gravecreek, Musty, and Rogue soils; Rock outcrop; Atring and Kanid soils on the more sloping parts of the landscape; Lettia soils on the less sloping parts of the landscape and on concave slopes; and soils that are similar to the Steinmetz soil but have bedrock within a depth of 60 inches. Also included are small areas of Steinmetz soils that have slopes of less than 35 or more than 75 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Steinmetz soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes golden chinkapin, Whipplevine, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling

mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Madrone-Chinkapin Forest.

182E—Straight extremely gravelly loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite, tuff, and breccia. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown extremely gravelly loam about 9 inches thick. The next layer is dark brown very gravelly loam about 10 inches thick. The upper 11 inches of the subsoil also is dark brown very gravelly loam. The lower 5 inches is dark brown very cobbly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or stony.

Included in this unit are small areas of Freezener and Geppert soils, Rock outcrop and Shippa soils on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Straight soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Straight soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Straight soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific dogwood. The understory vegetation includes Pacific serviceberry, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100 year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is

harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Dogwood Forest.

183E—Straight extremely gravelly loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite, tuff, and breccia. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown extremely gravelly loam about 9 inches thick. The next layer is dark brown very gravelly loam about 10 inches thick. The upper 11 inches of the subsoil also is dark brown very gravelly loam. The lower 5 inches is dark brown very cobbly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or stony.

Included in this unit are small areas of Freezener and Geppert soils, Rock outcrop and Shippa soils on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Straight soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Straight soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Straight soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include sugar pine, ponderosa pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase

the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

184G—Straight-Shippa extremely gravelly loams, 35 to 70 percent north slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Straight soil and 20 percent Shippa soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Freezener and Geppert soils and Rock outcrop on ridges and convex slopes, soils that are similar to the Straight soil but have bedrock at a depth of more than 40 inches, and soils that are similar to the Shippa soil but have bedrock within a depth of 10 inches. Also included are small areas of Straight and Shippa soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 20 percent of the total acreage.

The Straight soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown extremely gravelly loam about 9 inches thick. The next layer is dark brown very gravelly loam about 10 inches thick. The upper 11 inches of the subsoil also is dark brown very gravelly loam. The lower 5 inches is dark brown very cobbly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or stony.

Permeability is moderate in the Straight soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Shippa soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark brown extremely gravelly loam about 4 inches thick. The subsoil is brown extremely cobbly loam about 12 inches thick. Bedrock is at a depth of about 16 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Shippa soil. Available water capacity is about 1 inch. The effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific dogwood. The understory vegetation includes Pacific serviceberry, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115 on the Straight soil. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85 on the Shippa soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand

of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock underlying the Shippa soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. In areas of the Shippa soil, however, road cutbanks may not respond well to seeding and mulching because of the large amount of fractured bedrock that is exposed. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in both soils and the limited depth of the Shippa soil also increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Dogwood Forest.

185G—Straight-Shippa extremely gravelly loams, 35 to 60 percent south slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Straight soil and 25 percent Shippa soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Freezener and Geppert soils, Rock outcrop on ridges and convex slopes, soils that are similar to the Straight soil but have bedrock at a depth of more than 40 inches, and soils that are similar to the Shippa soil but have bedrock

within a depth of 10 inches. Also included are small areas of Straight and Shippa soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

The Straight soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown extremely gravelly loam about 9 inches thick. The next layer is dark brown very gravelly loam about 10 inches thick. The upper 11 inches of the subsoil also is dark brown very gravelly loam. The lower 5 inches is dark brown very cobbly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or stony.

Permeability is moderate in the Straight soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Shippa soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark brown extremely gravelly loam about 4 inches thick. The subsoil is brown extremely cobbly loam about 12 inches thick. Bedrock is at a depth of about 16 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Shippa soil. Available water capacity is about 1 inch. The effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include sugar pine, ponderosa pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Straight soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85 on the Shippa soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock underlying the Shippa soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. In areas of the Shippa soil, however, road cutbanks may not respond well to seeding and mulching because of the large amount of fractured bedrock that is exposed. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in both soils and the limited depth of the Shippa soil also increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested,

leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

186H—Tablerock-Rock outcrop complex, 35 to 110 percent slopes. This map unit is on hillslopes. Elevation is 1,250 to 3,600 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly hardwoods and conifers and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Tablerock soil and 35 percent Rock outcrop. The Tablerock soil has slopes of 35 to 50 percent, and Rock outcrop has slopes of more than 50 percent. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Carney, Darow, and Heppsie soils; soils that are similar to Carney soils but have bedrock at a depth of less than 20 or more than 40 inches; and Brader and Debenger soils and on ridges and convex slopes. Also included are small areas of soils that are similar to the Tablerock soil but have bedrock within a depth of 60 inches. Included areas make up about 20 percent of the total acreage.

The Tablerock soil is very deep and moderately well drained. It formed in colluvium derived dominantly from andesite and sandstone. Typically, the surface is covered with a layer of leaves and twigs about 1½ inches thick. The surface layer is very dark brown gravelly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly clay loam about 7 inches thick. The upper 10 inches of the subsoil is dark brown very cobbly clay loam. The next 18 inches is brown very cobbly clay. The lower 27 inches is dark yellowish brown gravelly clay loam and gravelly loam. Weathered bedrock is at a depth of about 65 inches. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is very slow in the Tablerock soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The water table fluctuates between depths of 4 and 6 feet from December through April.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for recreational development and livestock grazing.

The main limitations affecting recreational development are the slope, the Rock outcrop, and the high content of clay, which makes the soil sticky and plastic when wet and thus restricts trafficability. These limitations restrict the use of this unit mainly to paths and trails, which should extend across the slope. The steep slopes and the Rock outcrop should be avoided unless they are to be highlighted in the development.

The main limitations affecting livestock grazing are erosion, compaction, the slope, droughtiness, and the Rock outcrop. The vegetation suitable for grazing includes Idaho fescue, prairie junegrass, and western fescue. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

This unit is poorly suited to range seeding. The main limitations are the slope, droughtiness, and the Rock outcrop. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The steeper slopes and the Rock outcrop limit

access by livestock. As a result, the less sloping areas tend to be overgrazed. Constructing trails or walkways allows livestock to graze in areas where access is limited.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the Rock outcrop and the slope.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the Rock outcrop.

The vegetative site is Pine-Douglas Fir-Fescue.

187A—Takilma cobbly loam, 0 to 3 percent slopes. This very deep, well drained soil is on stream terraces. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 2,500 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown cobbly loam about 6 inches thick. The upper 9 inches of the subsoil is very dark grayish brown very cobbly loam. The lower 9 inches is brown extremely cobbly sandy loam. The substratum to a depth of 60 inches is dark yellowish brown and brown extremely gravelly and very gravelly sandy loam.

Included in this unit are small areas of Evans, Newberg, and Camas soils on flood plains; Medford soils on the lower terraces; poorly drained soils near drainageways; Central Point and Foehlin soils; and soils that are similar to the Takilma soil but have a substratum of very gravelly sand. Also included are small areas of Takilma soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Takilma soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for hay and pasture. It also is used for homesite development and livestock grazing.

This unit is suited to hay and pasture. The main limitations are droughtiness and cobbles on the surface. The cobbles limit the use of equipment in some areas. In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the moderately rapid permeability and the large number of rock fragments on and below the surface.

The suitability of this unit for septic tank absorption fields is limited because the extremely gravelly substratum has a poor filtering capacity. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Establishing plants is difficult in areas where the surface layer has been removed. Mulching and applying fertilizer help to establish plants in cut areas. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The main limitations affecting livestock grazing are compaction, the cobbly surface layer, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure.

Range seeding is suitable if the site is in poor condition. The main limitations are the cobbly surface layer and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment is limited by the cobbles on the surface.

This unit is limited as a site for livestock watering ponds and other water impoundments because of seepage.

The vegetative site is Pine-Douglas Fir-Fescue.

188E—Tallowbox gravelly sandy loam, 20 to 35 percent north slopes. This moderately deep, somewhat excessively drained soil is on hillslopes and ridges. It formed in colluvium derived from granitic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown gravelly sandy loam about 6 inches thick. The upper 6 inches of the subsoil is dark brown sandy loam. The lower 11 inches is brown gravelly sandy loam. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in the unit are small areas of Offenbacher, Shefflein, and Vannoy soils; Caris and Voorhies soils on the more sloping parts of the landscape; Ruch soils on toe slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Tallowbox soil but have bedrock at a depth of less than 20 or more than 40 inches. Also included are small areas of Tallowbox soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Tallowbox soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 100. The yield at culmination of the mean annual increment is 4,080 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 44,640 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When

the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir Forest.

188G—Tallowbox gravelly sandy loam, 35 to 70 percent north slopes. This moderately deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown gravelly sandy loam about 6 inches thick. The upper 6 inches of the subsoil is dark brown sandy loam. The lower 11 inches is brown gravelly sandy loam. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Caris, Offenbacher, Vannoy, and Voorhies soils; soils that are similar to the Tallowbox soil but have bedrock at a depth of less than 20 or more than 40 inches; and Tallowbox soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Tallowbox soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 100. The yield at culmination of the mean annual increment is 4,080 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 44,640 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during

summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir Forest.

189E—Tallowbox gravelly sandy loam, 20 to 35 percent south slopes. This moderately deep, somewhat excessively drained soil is on hillslopes and ridges. It formed in colluvium derived from granitic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown gravelly sandy loam about 6 inches thick. The upper 6 inches of the subsoil is dark brown sandy loam. The lower 11 inches is brown gravelly sandy loam. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in the unit are small areas Offenbacher and Vannoy soils, soils that are similar to the Tallowbox soil but have bedrock at a depth of less than 20 or more than 40 inches, Caris and Voorhies soils on the more sloping parts of the landscape, Ruch soils on toe slopes, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Tallowbox soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Tallowbox soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and Idaho fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial

reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Mixed Pine-Douglas Fir-Fescue Forest, Granitic.

189G—Tallowbox gravelly sandy loam, 35 to 60 percent south slopes. This moderately deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown gravelly sandy loam about 6 inches thick. The upper 6 inches of the subsoil is dark brown sandy loam. The lower 11 inches is brown gravelly sandy loam. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Caris, Offenbacher, Vannoy, and Voorhies soils on concave slopes or on the less sloping parts of the landscape; soils that are similar to the Tallowbox soil but have bedrock at a depth of less than 20 or more than 40 inches; and Tallowbox soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Tallowbox soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and Idaho fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a

greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Mixed Pine-Douglas Fir-Fescue Forest, Granitic.

190E—Tatouche gravelly loam, 12 to 35 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is very dark brown gravelly loam about 11 inches thick. The upper 8 inches of the subsoil is dark brown gravelly clay loam. The lower 41 inches is dark brown clay. The substratum to a depth of 73 inches is strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of Pinehurst soils; Bybee, Kanutchan, and Sibannac soils near drainageways and on concave slopes; Farva soils on convex slopes; and soils that are similar to the Tatouche soil but have bedrock within a depth of 60 inches. Also included are small areas of Tatouche soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Tatouche soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and whitevein shinleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper

livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Oceanspray Forest.

190G—Tatouche gravelly loam, 35 to 65 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is very dark brown gravelly loam about 11 inches thick. The upper 8 inches of the subsoil is dark brown gravelly clay loam. The lower 41 inches is dark brown clay. The substratum to a depth of 73 inches is strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of Bybee and Pinehurst soils on concave slopes and on the less sloping parts of the landscape, Woodseye and Farva soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Tatouche soil but have bedrock within a depth of 60 inches. Also included are small areas of Tatouche soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Tatouche soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and whitevein shinleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native

vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Oceanspray Forest.

191E—Tatouche gravelly loam, 12 to 35 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is very dark brown gravelly loam about 11 inches thick. The upper 8 inches of the subsoil is dark brown gravelly clay loam. The lower 41 inches is dark brown clay. The substratum to a depth of 73 inches is strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of Pinehurst soils; Bybee, Kanutchan, and Sibannac soils near drainageways and on concave slopes; Farva soils and Rock outcrop on ridges and convex slopes; and soils that are similar to the Tatouche soil but have bedrock within a depth of 60 inches. Also included are small areas of Tatouche soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Tatouche soil. Available water capacity is about 6.5 to 11 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial

reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

191G—Tatouche gravelly loam, 35 to 60 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is very dark brown gravelly loam about 11 inches thick. The upper 8 inches of the subsoil is dark brown gravelly clay loam. The lower 41 inches is dark brown clay. The substratum to a depth of 73 inches is strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of Bybee and Pinehurst soils on concave slopes and on the less sloping parts of the landscape, Woodseye and Farva soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Tatouche soil but have bedrock within a depth of 60 inches. Also included are small areas of Tatouche soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Tatouche soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads

may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

192A—Terrabella clay loam, 0 to 3 percent slopes. This very deep, poorly drained soil is in basins. It formed in alluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 3,500 feet. The mean annual precipitation is 25 to 45 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is very dark brown clay loam about 10 inches thick. The upper 18 inches of the subsoil is dark reddish brown and dark reddish gray clay. The lower 22 inches is dark brown clay. The substratum is dark yellowish brown gravelly clay loam about 10 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Coker, Freezener, and Geppert soils; very poorly drained, organic soils; and soils that are similar to the Terrabella soil but have bedrock within a depth of 60 inches. Also included are small areas of Terrabella soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is slow in the Terrabella soil. Available water capacity is about 11 inches. The effective rooting depth is limited by the water table, which is 0.5 foot above to 1.0 foot below the surface from December through May. Runoff is ponded, and the hazard of water erosion is slight. This soil is subject to rare flooding.

This unit is used for hay and pasture (fig. 14) and for wildlife habitat. This unit is suited to hay and pasture. The main limitations are the seasonal wetness, compaction, the high content of clay, and a slow rate of water intake. The wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill.

If the pasture is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

Tufted hairgrass is the native plant preferred for livestock grazing; however, this unit can be renovated and forage production increased by seeding other suitable grasses. The plants selected for seeding should be those that are tolerant of wetness.

Sprinkler irrigation is the best method of applying water. Border and contour flood irrigation systems also are suitable. Because of the slow rate of water intake and the slow permeability, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land leveling helps to ensure a uniform application of water. Fertilizer is needed to ensure the optimum growth of grasses and

Figure 14.—Livestock grazing in an area of Terrabella clay loam, 0 to 3 percent slopes. Freezener-Geppert complex, 12 to 35 percent south slopes, is in the background.

legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The vegetative site is Wet Meadow.

193G—Tethrick sandy loam, 35 to 75 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark grayish brown and brown sandy loam about 10 inches thick. The subsoil is yellowish brown and very pale brown sandy loam about 39 inches thick. The substratum to a depth of 60 inches is very pale brown sandy loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Dubakella, Goolaway, and Musty soils; Rock outcrop; Atring and Kanid soils on the more sloping parts of the landscape; and Wolfpeak soils on the less sloping parts of the landscape and on concave slopes. Also included are small areas of Siskiyou soils on ridges, soils that are similar to the Tethrick soil but have bedrock at a depth of 40 to 60 inches, and Tethrick soils that have slopes of less than 35 or more than 75 percent. Included areas

make up about 20 percent of the total acreage.

Permeability is moderate in the Tethrick soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

194G—Tethrick sandy loam, 35 to 75 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark grayish brown and brown sandy loam about 10 inches thick. The subsoil is yellowish brown and very pale brown sandy loam about 39 inches thick. The substratum to a depth of 60 inches is very pale brown sandy loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Dubakella, Goolaway, and Musty soils; Rock outcrop; Atring and Kanid soils on the more sloping parts of the landscape; and Wolfpeak soils on the less sloping parts of the landscape and on concave slopes. Also included are small areas of Siskiyou soils on ridges, soils that are similar to the Tethrick soil but have bedrock at a depth of 40 to 60 inches, and Tethrick soils that have slopes of less than 35 or more than 75 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Tethrick soil. Available water capacity is about 6 inches. The effective

rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Black Oak Forest.

195E—Vannoy silt loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ¾ inch thick. The surface layer is dark brown silt loam about 4 inches thick. The next layer is reddish brown silt loam about 7 inches thick. The subsoil is yellowish red clay loam about 27 inches thick. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or very gravelly.

Included in this unit are small areas of Rock outcrop and McMullin soils on ridges and convex slopes; Selmac soils on concave slopes; Caris and Offenbacher soils on the more sloping parts of the landscape; and Manita, Ruch, and Voorhies soils. Also included are small areas of soils that are similar to the Vannoy soil but have bedrock at a depth of more than 40 inches, poorly drained soils near drainageways, and Vannoy soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Vannoy soil.

Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for timber production. It also is used for pasture and homesite development.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, ponderosa pine, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations in the areas used as pasture are the slope, erosion, and droughtiness. Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Because of low rainfall in summer, forage production would be increased if this unit were irrigated. Irrigation is difficult, however, because of a limited water supply and the slope.

The main limitations affecting homesite development are the depth to bedrock, the slope, the moderately slow permeability, and low strength. The moderately slow permeability is a limitation on sites for septic tank absorption fields. It can be overcome by increasing the size of the absorption field. Because of the slope, the absorption lines should be installed on the contour. Areas where the soil is deeper and less sloping may be suited to septic tank absorption fields. Onsite investigation is needed to locate such areas.

The slope limits the use of some areas for building site development. Cuts needed to provide essentially level building sites can expose bedrock. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Douglas Fir Forest.

195F—Vannoy silt loam, 35 to 55 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the

average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ¾ inch thick. The surface layer is dark brown silt loam about 4 inches thick. The next layer is reddish brown silt loam about 7 inches thick. The subsoil is yellowish red clay loam about 27 inches thick. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or very gravelly loam.

Included in this unit are small areas of Voorhies soils, Caris and Offenbacher soils on the more sloping parts of the landscape, McMullin soils and Rock outcrop on ridges and convex slopes, Manita soils on the less sloping parts of the landscape and on concave slopes, and soils that are similar to the Vannoy soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Vannoy soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Vannoy soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, ponderosa pine, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. When the soil is dry, ripping skid trails and landings improves the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The vegetative site is Douglas Fir Forest.

196E—Vannoy silt loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ¾ inch thick. The surface layer is dark brown silt loam about 4 inches thick. The next layer is reddish brown silt loam about 7 inches thick. The subsoil is yellowish red clay loam about 27 inches thick. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from

20 to 40 inches. In some areas the surface layer is gravelly or very gravelly.

Included in this unit are small areas of Rock outcrop and McMullin soils on ridges and convex slopes; Selmac soils on concave slopes; Caris and Offenbacher soils on the more sloping parts of the landscape; and Manita, Ruch, and Voorhies soils. Also included are small areas of soils that are similar to the Vannoy soil but have bedrock at a depth of more than 40 inches, poorly drained soils near drainageways, and Vannoy soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Vannoy soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for timber production. It also is used for pasture and homesite development.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations in the areas used as pasture are the slope, erosion, and droughtiness. Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Because of low rainfall in summer, forage production would be increased if this unit were irrigated. Irrigation is difficult, however, because of a limited water supply and the slope.

The main limitations affecting homesite development are the depth to bedrock, the slope, the moderately slow permeability, and low strength. The moderately slow permeability is a limitation on sites for septic tank absorption fields. It can be overcome by increasing the size of the absorption field. Because of the slope, the absorption lines should be installed on the contour. Areas where the soil is deeper and less sloping may be suited to septic tank absorption fields. Onsite investigation is needed to locate such areas.

The slope limits the use of some areas for building

site development. Cuts needed to provide essentially level building sites can expose bedrock. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Pine-Douglas Fir-Fescue.

197F—Vannoy-Voorhies complex, 35 to 55 percent south slopes. This map unit is on hillslopes. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Vannoy soil and 30 percent Voorhies soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes, Caris and Offenbacher soils on the more sloping parts of the landscape, Manita soils on the less sloping parts of the landscape and on concave slopes, and soils that are similar to the Vannoy soil but have bedrock at a depth more than 40 inches. Also included are small areas of Vannoy and Voorhies soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 10 percent of the total acreage.

The Vannoy soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about ¾ inch thick. The surface layer is dark brown silt loam about 4 inches thick. The next layer is reddish brown silt loam about 7 inches thick. The subsoil is yellowish red clay loam about 27 inches thick. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or very gravelly loam.

Permeability is moderately slow in the Vannoy soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Voorhies soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark grayish brown and dark brown very gravelly loam about 8 inches thick. The upper 10 inches of the subsoil is brown very gravelly clay loam. The lower 18 inches is brown very cobbly clay loam. Weathered bedrock is at a depth of about 36 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Voorhies soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Vannoy soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90 on the Vannoy soil. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the Voorhies soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 75 on the Voorhies soil. The yield at culmination of the mean annual increment is 3,100 cubic feet per acre in a fully stocked, even-aged stand of trees at 50 years and 31,680 board feet per acre (Scribner rule) at 160 years.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a large number of rock fragments is left on the surface. Using standard

wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the Voorhies soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site is Pine-Douglas Fir-Fescue.

198A—Winlo very gravelly clay loam, 0 to 3 percent slopes. This somewhat poorly drained soil is on fan terraces. It is shallow to a hardpan. It formed in alluvium derived from mixed sources. Elevation is 1,100 to 1,500 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly rushes, sedges, and grasses and scattered water-tolerant hardwoods.

Typically, the surface layer is very dark grayish brown very gravelly clay loam about 4 inches thick. The upper 5 inches of the subsoil is dark brown very gravelly clay. The lower 8 inches is a hardpan. The substratum to a depth of 60 inches is light olive brown extremely gravelly coarse sandy loam. Depth to the hardpan is 7 to 15 inches. The depth to bedrock is 60 inches or more. In some areas the surface layer is very cobbly or very gravelly clay.

Included in this unit are small areas of Agate soils, soils that are similar to the Winlo soil but have a hardpan at a depth of more than 15 inches, and Cove and Padigan soils on concave slopes and near drainageways. Also included are small areas of Winlo soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Winlo soil. Available water capacity is about 1 inch. The effective rooting depth is 7 to 15 inches. Runoff is ponded, and the hazard of water erosion is slight. The water table is 0.5 foot above to 0.5 foot below the surface from December through February.

This unit is used mainly for pasture. It also is used for homesite development.

The main limitations in the areas used as pasture are wetness in winter and spring, droughtiness in summer and fall, depth to the hardpan, the very gravelly surface layer, and compaction. If the pasture is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. Wetness limits the choice of suitable forage plants and the period of grazing and increases the risk of winterkill. The use of ground equipment is limited by the gravel and cobbles on the surface.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. If possible, periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to a hardpan.

In summer, irrigation is needed for maximum forage production. Sprinkler irrigation is the best method of applying water. Contour flood irrigation also is suitable. Because of the slow permeability and the depth to a hardpan, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land leveling is not practical because of the depth to a hardpan.

Tile drainage systems are not practical because of the depth to a hardpan. Open ditches may be used to reduce surface wetness.

This unit is poorly suited to homesite development. The main limitations are the wetness, depth to the hardpan, and the very gravelly surface layer.

This unit is poorly suited to standard systems of waste disposal because of the wetness and the depth to a hardpan. Alternative waste disposal systems may function properly on this unit. Suitable included soils are in some areas of the unit. Onsite investigation is needed to locate such soils.

Because the seasonal high water table is perched above the hardpan, a drainage system is needed on sites for buildings with basements and crawl spaces. A drainage system also is needed if roads or building foundations are constructed. Excess water can be removed by suitably designed drainage ditches.

Cuts needed to provide essentially level building sites can expose the hardpan. Establishing plants is difficult in areas where the hardpan has been exposed. Mulching and applying fertilizer help to establish plants in cut areas. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Poorly Drained Bottom.

199C—Wolfpeak sandy loam, 3 to 12 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in residuum and alluvium derived dominantly from granitic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown sandy loam about 4 inches thick. The next layer is brown sandy loam about 7 inches thick. The subsoil to a depth of 60 inches is yellowish brown and strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam.

Included in this unit are small areas of Clawson soils near drainageways and on concave slopes, Josephine and Pollard soils, and soils that are similar to the Wolfpeak soil but have bedrock within a depth of 60 inches. Also included are small areas of Wolfpeak soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Wolfpeak soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate.

This unit is used mainly for timber production or wildlife habitat. It also is used for hay and pasture and for homesite development.

This unit is suited to irrigation crops. It is limited mainly by the moderately slow permeability and the hazard of erosion. In summer, irrigation is needed for the maximum production of most crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. The main limitations are the moderately slow permeability and the shrink-swell potential. The moderately slow permeability is a limitation on sites for septic tank absorption fields. It can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and sugar pine. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are compaction, erosion, plant competition, and seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

200E—Wolfpeak sandy loam, 12 to 35 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium and residuum derived from granitic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown sandy loam about 4 inches thick. The next layer is brown sandy loam about 7 inches thick. The subsoil to a depth of 60 inches is yellowish brown and strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam.

Included in this unit are small areas of Josephine, Goolaway, Musty, and Pollard soils; Tethrick soils on the more sloping parts of the landscape; and Siskiyou soils on ridges and convex slopes. Also included are small areas of poorly drained soils near drainageways and on concave slopes, soils that are similar to the Wolfpeak soil but have bedrock within a depth of 60 inches, and Wolfpeak soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Wolfpeak soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory

vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

201E—Wolfpeak sandy loam, 12 to 35 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium and residuum derived from granitic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown sandy loam about 4 inches thick. The next layer is brown sandy loam about 7 inches thick. The subsoil to a depth of 60 inches is yellowish brown and strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam.

Included in this unit are small areas of Josephine, Goolaway, Musty, and Pollard soils; Tethrick soils on the more sloping parts of the landscape; and Siskiyou soils on ridges and convex slopes. Also included are small areas of poorly drained soils near drainageways and on concave slopes, soils that are similar to the Wolfpeak soil but have bedrock within a depth of 60 inches, and Wolfpeak soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Wolfpeak soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant

competition. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Black Oak Forest.

202F—Woodcock stony loam, 35 to 55 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 3,800 to 6,500 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 40 to 43 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 4 inches thick. The next layer is dark reddish brown very gravelly loam about 12 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 23 inches thick. The substratum to a depth of 62 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Merlin soils and Rock outcrop on ridges and convex slopes, Pokegema soils on the less sloping parts of the landscape, and soils that are similar to the Woodcock soil but have bedrock within a depth of 60 inches. Also included are small areas of Woodcock soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Woodcock soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include white fir, incense cedar, and sugar pine. The understory vegetation includes sierra chinkapin, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index is 110 for Douglas fir and 105 for ponderosa pine. The yield of ponderosa pine at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are the slope, erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur

when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, sedge, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Conifer-Chinkapin-Sedge Forest.

203F—Woodcock stony loam, 35 to 55 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 3,800 to 6,500 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 40 to 43 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 4 inches thick. The next layer is dark reddish brown very gravelly loam about 12 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 23 inches thick. The substratum to a depth of 62 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Merlin soils and Rock outcrop on ridges and convex slopes, Pokegema soils on the less sloping parts of the landscape, and soils that are similar to the Woodcock soil but have bedrock within a depth of 60 inches. Also included are small areas of Woodcock soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Woodcock soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include white fir, incense cedar, and sugar pine. The understory vegetation includes sierra chinkapin, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index is 105 for Douglas fir and 95 for ponderosa pine. The yield of ponderosa pine at culmination of the mean annual increment is 3,760 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 43,160 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less

surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, sedge, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Conifer-Chinkapin-Sedge Forest.

204E—Woodcock-Pokegema complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 3,800 to 6,500 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 40 to 43 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Woodcock soil and 25 percent Pokegema soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Merlin soils and Rock outcrop on ridges and convex slopes, Klamath soils near drainageways and on concave slopes, soils that are similar to the Woodcock soil but have bedrock within a depth of 60 inches, and soils that are similar to the Pokegema soil but have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Woodcock and Pokegema soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Woodcock soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 4 inches thick. The next layer is dark reddish brown very gravelly loam about 12 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 23 inches thick. The substratum to a depth of 62 inches is dark reddish

brown gravelly clay loam. The depth to bedrock is 60 inches or more.

Permeability is moderate in the Woodcock soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Pokegema soil is deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is dark reddish brown loam about 8 inches thick. The upper 8 inches of the subsoil is dark reddish brown clay loam. The lower 22 inches is dark reddish brown gravelly clay. The substratum is dark reddish brown and reddish brown gravelly clay about 14 inches thick. Weathered bedrock is at a depth of about 52 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Pokegema soil. Available water capacity is about 6 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include white fir, incense cedar, and sugar pine. The understory vegetation includes sierra chinkapin, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Woodcock soil and 120 on the Pokegema soil.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 105 on both the Woodcock and Pokegema soils. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction.

Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, sedge, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Conifer-Chinkapin-Sedge Forest.

205E—Woodcock-Pokegema complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 3,800 to 6,500 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 40 to 43 degrees F, and the average frost-free period is less than 100 days. The native

vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Woodcock soil and 25 percent Pokegema soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Merlin soils and Rock outcrop on ridges and convex slopes, Klamath soils near drainageways and on concave slopes, soils that are similar to the Woodcock soil but have bedrock within a depth of 60 inches, and soils that are similar to the Pokegema soil but have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Woodcock and Pokegema soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Woodcock soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 4 inches thick. The next layer is dark reddish brown very gravelly loam about 12 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 23 inches thick. The substratum to a depth of 62 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more.

Permeability is moderate in the Woodcock soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Pokegema soil is deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is dark reddish brown loam about 8 inches thick. The upper 8 inches of the subsoil is dark reddish brown clay loam. The lower 22 inches is dark reddish brown gravelly clay. The substratum is dark reddish brown and reddish brown gravelly clay about 14 inches thick. Weathered bedrock is at a depth of about 52 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Pokegema soil. Available water capacity is about 6 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include white fir, incense cedar, and sugar pine. The understory vegetation includes sierra chinkapin, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105 on the Woodcock soil and 120 on the Pokegema soil.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 95 on the Woodcock soil. The yield at culmination of the mean annual increment is 3,760 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 43,160 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 105 on the Pokegema soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer and an

insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Woodcock soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, sedge, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Conifer-Chinkapin-Sedge Forest.

206E—Woodcock-Pokegema complex, warm, 12 to 35 percent slopes. This map unit is on hillslopes. It is mainly on south-facing slopes. Elevation is 4,300 to 5,400 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 43 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Woodcock soil and 25 percent Pokegema soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Merlin soils and Rock outcrop on ridges and convex slopes, Klamath soils near drainageways and on concave slopes, soils that are similar to the Woodcock soil but have bedrock within a depth of 60 inches, and soils that are similar to the Pokegema soil but have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Woodcock and Pokegema soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Woodcock soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 4 inches thick. The next layer is dark reddish brown very gravelly loam about 12 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 23 inches thick. The substratum to a depth of 62 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more.

Permeability is moderate in the Woodcock soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Pokegema soil is deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is dark reddish brown loam about 8 inches thick. The upper 8 inches of the subsoil is dark reddish brown clay loam. The lower 22 inches is dark reddish brown gravelly clay. The substratum is dark reddish brown and reddish brown gravelly clay about 14 inches thick. Weathered bedrock is at a depth of about 52 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Pokegema soil. Available water capacity is about 6 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include white fir, incense cedar, and sugar pine. The understory vegetation includes sierra chinkapin, antelope bitterbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105 on the Woodcock soil and 120 on the Pokegema soil.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 95 on the Woodcock soil. The yield at culmination of the mean annual increment is 3,760 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 43,160 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site

index for ponderosa pine is 105 on the Pokegema soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Woodcock soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, sedge, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Conifer-Bitterbrush-Sedge Forest.

207E—Woodseye-Rock outcrop complex, 3 to 35 percent slopes. This map unit is on hillslopes. Elevation is 4,000 to 6,000 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 65 percent Woodseye soil and 25 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Farva, Pinehurst, Rustlerpeak, Snowlin, and Tatouche soils; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Woodseye soil but have bedrock at a depth of less than 10 or more than 20 inches. Also included are small areas of Woodseye soils that have slopes of more than 35 percent. Included areas make up about 10 percent of the total acreage.

The Woodseye soil is shallow and somewhat excessively drained. It formed in colluvium derived dominantly from andesite. Typically, the surface layer is dark brown very stony loam about 2 inches thick. The next layer is dark brown very cobbly loam about 6 inches thick. The subsoil also is dark brown very cobbly loam. It is about 10 inches thick. Bedrock is at a depth of about 18 inches. The depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Woodseye soil. Available water capacity is about 1 inch. The effective rooting depth is 10 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction, erosion, the Rock outcrop, stones on the surface, droughtiness, and the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, pine bluegrass, and bluebunch wheatgrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the stones on the surface and the Rock outcrop.

This unit is poorly suited to range seeding. The main limitations are the depth to bedrock, droughtiness, the Rock outcrop, and the stones on the surface. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Loamy Juniper Scabland, 20- to 30-inch precipitation zone.

207G—Woodseye-Rock outcrop complex, 35 to 80 percent slopes. This map unit is on hillslopes. Elevation is 4,000 to 6,000 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 60 percent Woodseye soil and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Farva, Pinehurst, Rustlerpeak, Snowlin, and Tatouche soils; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Woodseye soil but have bedrock at a depth of less than 10 or more than 20 inches. Also included are small areas of Woodseye soils that have slopes of less than 35 or more than 80 percent. Included areas make up about 10 percent of the total acreage.

The Woodseye soil is shallow and somewhat excessively drained. It formed in colluvium derived dominantly from andesite. Typically, the surface layer is dark brown very stony loam about 2 inches thick. The next layer is dark brown very cobbly loam about 6 inches thick. The subsoil also is dark brown very cobbly loam. It is about 10 inches thick. Bedrock is at a depth of about 18 inches. The depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Woodseye soil. Available water capacity is about 1 inch. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are the slope, erosion, compaction, the Rock outcrop, stones on the surface, droughtiness, and the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, pine bluegrass, and bluebunch wheatgrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the stones on the surface, the Rock outcrop, and the slope.

This unit is poorly suited to range seeding. The main limitations are the slope, droughtiness, the depth to bedrock, the Rock outcrop, and the stones on the surface. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The slope and the Rock outcrop limit access by livestock. As a result, the less sloping areas tend to be overgrazed. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Loamy Juniper Scabland, 20- to 30-inch precipitation zone.

208C—Xerorthents-Dumps complex, 0 to 15 percent slopes. This map unit is in areas on flood plains, stream terraces, and alluvial fans where excavated material was deposited during mining operations. The material in this unit commonly is referred to as mine tailings. Slopes range from nearly level to hummocky. Elevation is 1,000 to 4,100 feet. The mean annual precipitation is 20 to 50 inches, the mean annual temperature is 43 to 54 degrees F, and the average frost-free period is 100 to 180 days. The vegetation on the Xerorthents is mainly scattered conifers and hardwoods and a sparse understory of grasses, shrubs, and forbs. The Dumps support very little, if any, vegetation.

This unit is about 35 percent Xerorthents and 30 percent Dumps.

Included in this unit are small areas of Camas, Evans, and Newberg soils on flood plains; Central Point, Foehlin, Medford, and Takilma soils on terraces; and Abegg, Josephine, Ruch, Shefflein, and Dumont soils on alluvial fans. Included areas make up about 35 percent of the total acreage.

The Xerorthents vary too considerably to be classified at the series level. They are cobbly clay loam to extremely cobbly sandy loam and have as much as 90 percent gravel, cobbles, and stones.

The Dumps consist mostly of gravel, cobbles, and stones and include little, if any, material of finer texture.

Permeability, available water capacity, and the effective rooting depth vary considerably in areas of this unit. There is a seasonal high water table in winter and spring, particularly in areas on flood plains.

This unit is a potential source of gravel. Most areas are limited as sites for other uses.

This unit is not assigned to a vegetative site.

Prime Farmland

In this section, prime farmland is defined and the soils in the survey area that are considered prime farmland are listed.

Prime farmland is of major importance in meeting the Nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to food, seed, forage, fiber, and oilseed crops. Such soils have properties that favor the economic production of sustained high yields of crops. The soils need only to be treated and managed by acceptable farming methods. An adequate moisture supply and a sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be used as cropland, pasture, or woodland or for other purposes. They either are used for food and fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites and as sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water-control structures. Public land is land not available for farming in national forests, national parks, and state parks and on military reservations.

Prime farmland soils commonly receive an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and length of growing season are favorable, and the level of acidity or alkalinity is acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland soils if these limitations are overcome by drainage systems, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information about the criteria for prime farmland can be obtained at the local office of the Soil Conservation Service.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

About 123,000 acres, or nearly 8 percent of the survey area, would meet the requirements for prime farmland if an adequate and dependable supply of irrigation water were available.

The following map units meet the requirements for prime farmland. On some soils included in the list, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. The location of each map unit is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

1B	Abegg gravelly loam, 2 to 7 percent slopes (where irrigated)
1C	Abegg gravelly loam, 7 to 12 percent slopes (where irrigated)
2A	Abin silty clay loam, 0 to 3 percent slopes
8A	Barhiskey gravelly loamy sand, 0 to 3 percent slopes (where irrigated)
9A	Barhiskey Variant gravelly loamy sand, 0 to 3 percent slopes (where irrigated and drained)
10B	Barron coarse sandy loam, 0 to 7 percent slopes (where irrigated)
31A	Central Point sandy loam, 0 to 3 percent slopes
32B	Clawson sandy loam, 2 to 5 percent slopes (where drained)

34B	Coleman loam, 0 to 7 percent slopes (where drained)
43B	Darow silty clay loam, 1 to 5 percent slopes
51C	Dumont gravelly clay loam, 1 to 12 percent slopes
55A	Evans loam, 0 to 3 percent slopes
61A	Foehlin gravelly loam, 0 to 3 percent slopes
62C	Freezener gravelly loam, 1 to 12 percent slopes
76A	Gregory silty clay loam, 0 to 3 percent slopes (where drained)
86C	Hukill gravelly loam, 1 to 12 percent slopes
97A	Kerby loam, 0 to 3 percent slopes
98A	Kerby loam, wet, 0 to 3 percent slopes (where drained)
100A	Kubli loam, 0 to 3 percent slopes (where drained)
100B	Kubli loam, 3 to 7 percent slopes (where drained)
106C	Lobert sandy loam, 0 to 12 percent slopes (where irrigated)
108B	Manita loam, 2 to 7 percent slopes
127A	Medford silty clay loam, 0 to 3 percent slopes
128B	Medford clay loam, gravelly substratum, 0 to 7 percent slopes
133A	Newberg fine sandy loam, 0 to 3 percent slopes (where irrigated)
149B	Pollard loam, 2 to 7 percent slopes
157B	Ruch silt loam, 2 to 7 percent slopes
158B	Ruch gravelly silt loam, 2 to 7 percent slopes
162B	Selmac loam, 2 to 7 percent slopes (where drained)
163A	Sevenoaks loamy sand, 0 to 3 percent slopes (where irrigated)
164B	Shefflein loam, 2 to 7 percent slopes
192A	Terrabella clay loam, 0 to 3 percent slopes (where drained)
199C	Wolfpeak sandy loam, 3 to 12 percent slopes

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as grazing land and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

By Ron Mobley, Oregon State University Extension Service, and Nicola Giardina, soil conservationist, Soil Conservation Service.

General management needed for crops and for hay and pasture is suggested in this section. The system of land capability classification used by the Soil Conservation Service is explained, and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In this survey area about 301,870 acres is in areas of farms and ranches. About 59,782 acres of the farmland is irrigated. Among the crops grown in 1987 were 7,700 acres of Bartlett and winter pears, 560 acres of other fruit and nuts, 150 acres of grapes, 360 acres of vegetable and nursery crops, 26,550 acres of hay and silage crops, 3,700 acres of grain, 460 acres of seed crops, and 20,300 acres of irrigated pasture. The cropland is mainly in the valleys of the Rogue and Applegate Rivers and of Bear, Evans, and Butte Creeks.

The soils in the survey area have many characteristics that affect their behavior and response to management for various uses. The productivity of each soil under given management practices can be maintained or improved only if the unique characteristics of the soils are understood and the best management practices are applied.

One such characteristic is the tendency of the soils to become compacted as a result of tillage, machinery traffic, or livestock use during wet periods. Compaction commonly restricts permeability and root development, reduces the rate of water intake, and increases the runoff rate and the hazard of erosion. Under these conditions, the productivity of the soils is reduced and the loss of soil and water is increased. Proper management practices can prevent compaction, maintain productivity, and protect the soils from further degradation.

The effects of erosion are most critical on the steeper slopes and on the soils that formed in granitic material. These effects include the loss of organic matter, the breakdown of the natural structure of the soils, and

alteration of the texture of the soils through the loss of clay and silt, all of which result in deterioration of the tilth, workability, and productivity of the soils.

The productivity of the soils is reduced through the loss of nutrients and soil particles. The soil resource is not renewed through natural processes within a short period. Many hundreds of years is required to replace part of an eroded surface layer, although appropriate cultural practices and soil amendments can hasten the redevelopment of the soil. Soil particles, nutrients, and chemicals transported by water into streams and ponds degrade the quality of the water. Erosion can increase the turbidity of streams and rivers and contaminate domestic water supplies. The deposition of eroding soil material can destroy spawning beds for fish. Removing this material from irrigation and drainage ditches and from ponds is costly.

The soils in the survey area that formed in granitic material, such as those of the Shefflein and Tallowbox series, are highly susceptible to erosion. Special emphasis should be placed on practices that control erosion and thus help to prevent the degradation of water quality.

Many management practices can control erosion. They include returning crop residue to the soil and growing grasses and shrubs as cover crops. Such cover crops protect the surface from the impact of raindrops or sprinkler irrigation water and reduce the loss of both soil material and water. The steeper soils are more susceptible to erosion because the velocity of the runoff on such soils is greater. The problem is compounded on the longer slopes, which have greater concentrations of runoff.

If farmed, loamy soils in areas on foothills where slopes are more than 10 percent are highly susceptible to erosion. Examples are Brader, Debenger, Ruch, and Shefflein soils. Suitable management practices on these soils include minimizing tillage, farming on the contour, returning crop residue to the soils, and terracing. For each kind of soil and crop, specific management practices are needed to minimize erosion.

Soil drainage is a concern in many areas. In some soils the seasonal high water table limits the choice of crops and management practices. The soils in the survey area that have a seasonal high water table are those of the Coker, Cove, Gregory, and Padigan series. The high water is primarily a result of the topography and the internal characteristics of the soils. Drainage problems may be compounded by the inefficient application of irrigation water. As water flows along the natural contours of the landscape, it can become concentrated, thus saturating the soils. Layers of dense clay and other impervious layers restrict the rooting depth in Winlo, Langellain, and Kubli soils. They also restrict the movement of water. As a result, the soils have a seasonal high water table.

Drainage can be improved in most areas by installing surface or subsurface drainage systems. Surface systems include diversions, open drainage ditches, grassed waterways, and land shaping, which eliminates depressions. Subsurface systems consist of either pattern or interceptor tile drains.

The problems associated with installing drainage systems are poor outlets, limited soil depth, and fine soil texture. If outlets are not available, the site cannot be drained unless excess water is pumped away from the site. A shallow soil depth increases installation costs and limits the effectiveness of drainage systems. Drainage lines in fine textured soils should be closely spaced because these soils are slowly permeable.

Where the soils have been drained, a wider variety of crops can be grown because of the improved movement of water and better root aeration, which promotes the growth and penetration of roots. Drainage systems allow for better water management, earlier warming of the soils, and better accessibility to the fields.

Although there are many advantages to draining soils for agricultural purposes, natural swamps and marshes provide important habitat for many kinds of wildlife. Draining these areas destroys this habitat. The environmental impact of installing a drainage system should be carefully considered.

Because of insufficient rainfall during the growing season, irrigation is necessary for high crop yields. The most important considerations in irrigated areas are the available water capacity and rate of water intake in the soils, the needs of the crop, and the availability of irrigation water. The available water capacity is the amount of water that soils can store for use by plants. The factors that affect this capacity are depth, texture, the content of rock fragments, and the content of organic matter.

The rate of water intake is determined by the texture, structure, and content of organic matter in the soils and by the kind of land use. Sandy soils absorb water rapidly and have a low available water capacity. Clayey soils absorb water slowly and have a comparatively high available water capacity. Water moves through soils that have good structure at a more desirable rate than it does through soils that have poor structure.

Crops require water at critical periods if maximum quality and production are to be achieved. To maintain a desirable growth rate, enough soil moisture must be available to the crops. The number of acres that can be irrigated in a given year is determined by the properties of the snowpack, the amount of water stored in the soils, and the streamflow.

The availability of irrigation water depends on the competitive demands of agriculture, recreation, wildlife, industry, and municipalities. Irrigation systems should be designed for the greatest efficiency. Runoff or drainage water can be filtered, collected, and then reused or returned to streams.

Sprinkler, furrow, border, flooding, and trickle irrigation systems commonly are used in the survey area. The system used depends on the characteristics of the soils, the cropping system, the crops to be grown, the availability of labor, and the cost. The water should not be applied at a rate that exceeds the intake rate of the soils.

Sprinkler irrigation is suitable on soils that have various slope ranges and rates of water intake and that are used for various crops. Sprinkler irrigation systems are used to control frost in spring and delay blossoming of fruit trees and grapevines. Few of the soils in the survey area are suited to flood irrigation systems that include borders and furrows because the soils so irrigated should be those that are nearly level and have uniform slopes. Such systems require that the soils be leveled and graded. They may be the best systems for certain row crops. Trickle irrigation systems are very efficient because they apply water only to the root zone. They are used mainly in areas of vine and tree crops.

Fertilizer is needed to provide the nutrients required by plants. For high yields and the efficient use of fertilizer, a planned application program is needed. On all the soils in the survey area, the amount of fertilizer and other amendments to be applied should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields.

Organic farming has become popular in the survey area during recent years. Applications of organic matter, such as animal manure, green manure, plant refuse, and compost, maintain or improve soil productivity and are beneficial in draining and warming the soils. Adding organic matter helps coarse textured soils to retain moisture and plant nutrients and improves the workability, rate of water intake, structure, and aeration of fine textured soils.

Many soils in the survey area have a high content of clay. Carney and Coker soils are examples. They have wide cracks when dry and are sticky and slick when wet. Other characteristics of these soils are a slow rate of water infiltration; the tenacious adherence of water to the clay particles, which makes it difficult for plants to extract water from the soils and thus causes wilting of plants when the soil moisture content is only 25 to 35 percent; a high buffering capacity, which tends to tie up or hold fertilizer and the chemicals used for weed control and thus may require that the application rate be increased; and a scarcity of unusual fertility problems, although the content of phosphorus and sulfur is low in some areas.

Management of these clayey soils is difficult. Establishing fall-seeded crops in nonirrigated areas of the soils is difficult because soil moisture conditions are unpredictable and frost heaving of seedlings occurs unless the plants are well established before frost conditions prevail in winter.

Because tilling is difficult, these clayey soils are better suited to such crops as pears, apples, and perennial forage crops than to annual crops. They are well suited to permanent forage crops, which provide excellent ground cover in the steeper areas, where erosion is a hazard. Some of the improved perennial grasses that can be grown in the survey area are fescues and ryegrasses. The suitable improved legumes grown for permanent forage include white clover and trefoil. Alfalfa generally grows best on soils that are characterized by good internal drainage; therefore, its production may be limited on these clayey soils because of their poor drainage in winter. Such crops as new pear plantings, vegetables, and berries may benefit from raised beds or seedbeds established on prepared ridges 5 to 6 inches high. Subsoiling or ripping does not provide long-term benefits in areas of these soils because only two or three irrigations or winter rains are needed to reseal the profile.

The management practices needed for the soils in the survey area to produce high yields of crops vary, depending on the kind of soil and the kind of crop. The local office of the Cooperative Extension Service or of the Soil Conservation Service can provide information about the management practices that are suitable on the various soils in the survey area.

Yields Per Acre

The average yields per acre that can be expected of the principal crops grown under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil farmed and the crop grown. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage;

control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops presently is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils generally are grouped at three levels—capability class, subclass, and unit *(24)*. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in table 5.

Livestock Grazing

By Gene Hickman, range conservationist, Soil Conservation Service.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for each soil, the vegetative site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Explanation of the column headings in table 6 follows.

A *vegetative site* is a distinctive kind of site that produces a characteristic natural plant community that differs from natural plant communities on other vegetative sites in kind, amount, and proportion of

forage plants. The relationship between the soils and vegetation in the survey area was ascertained during this survey; thus, vegetative sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of plants. Soil reaction, soil temperature, and a seasonal water table are also important.

Total production is the amount of vegetation that can be expected to grow annually in a well managed area that supports the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and the fruit of woody plants up to 4.5 feet high. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Characteristic vegetation—the grasses, forbs, shrubs, and trees that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The percent composition value is determined by air-dry weight or by the occurrence of individual species. If dry weight entries are given in the total production column, the percent composition is by air-dry weight. If there are no entries in the total production column, the percent composition entries were determined by the occurrence of individual species. The amount of vegetation that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Management of vegetative sites requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present condition of the site. Site condition is determined by comparing the present plant community with the potential natural plant community for a particular site. The more closely the existing community resembles the potential community, the better the site condition. Site condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in managing vegetative sites is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimal production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a site condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Historically, raising livestock, both sheep and cattle, has been vital to the economy of this survey area. Although the number of livestock has declined in recent years, livestock raising is still vital to the local economy and to the numerous ranch owners in the southern and eastern parts of the survey area.

Sheep ranching has changed from range-type operations to farm-type operations. Limited grazing of sheep in forest plantations as an alternative to applications of herbicide is being studied. These studies are providing very encouraging results.

Some of the considerations that are pertinent to grazing management in this survey area are the season of use, forage production, proper grazing use, water availability, grazing systems, fencing, deferred grazing, and rest periods.

Season of use.—This is the time of the year when a site is suitable for livestock grazing. It is determined by such factors as the length of the growing season, the kinds of soil on the site, and the effects of snow and other climatic considerations. The season of use varies considerably, depending on aspect, elevation, and climatic zones.

Sites that are characterized by medium textured, well drained soils and are dominated by white oak, juniper, and wedgeleaf ceanothus or are open grassland can be grazed from early in spring to late in fall. Sites in poor condition may have palatable available forage only in spring. Wet, clayey soils are subject to soil displacement and structural damage if they are grazed. Grazing on these soils should be delayed until late in spring, after most of the rainy season has passed. Because the growing season is short and the soils are wet much of the time, meadows should be grazed from summer until early in fall. Forested sites at the lower elevations can be grazed from late in spring through fall, and those at the higher elevations can be grazed from summer to early in fall.

Forage production.—Forage production varies greatly from site to site and under different conditions on the same site. The palatable or preferred grazing species are not always known, especially in forested areas,

unless the diet or use patterns of livestock are closely monitored. Fine- or soft-leaved grasses and edible forbs are the main forage plants grazed by cattle, although a number of palatable shrubs can provide forage from late in summer through fall.

Under normal conditions, meadows in good condition provide the highest forage yields. Deterioration of the meadows to poor condition results in changes in plant composition and less palatable and less usable forage. Open grassland and sites that support oak and pine are next highest in natural productivity. As with meadow sites, deterioration of these sites to poor condition reduces forage yields because of the invasion of unpalatable, weedy species. The grazing sites in areas of scabland are the lowest in natural productivity. On these sites there is little potential for improvement of forage production under any known management or improvement practices.

Forested sites provide a wide range of forage yields, even on the same vegetative site. During the successional stages of a stand, the availability of forage changes considerably in response to shading and competition among species. As timber stands become more mature, especially those of true fir and Douglas fir, most grazable areas gradually develop into brush fields, which provide less forage for livestock. As these sites pass from the dense brush stage through the sapling and young pole stages, little forage is produced or used by livestock. As the canopy begins to open in those stands that are in the older pole stage and in mature stands, forage again becomes available. Forage production on forested sites is influenced to a great extent by the timber harvesting methods used. Harvesting practices that maintain an open canopy tend to promote long-term production of a higher amount of forage.

Cattle prefer to graze in areas that are open or only very lightly shaded. Livestock generally avoid or make only limited use of forage on steep, timbered slopes. Heavily shaded sites are grazed very little under any conditions, but they may be used as bedding areas on warm days or cold nights. Consequently, most grazing in forested areas takes place in natural openings, in very lightly shaded areas, in clearings, in newly logged areas, in recently burned areas, on landings, and in roadside areas.

Because of all these factors, predicting the total amount of usable forage for a given site is difficult even when the history of the site is available. Generally, however, it can be assumed that the forage yield will be 50 to 300 pounds per acre for most forested communities in the optimum stages of forage production during the development of the stand.

Forage production could be increased on most grazing sites in the survey area, although increased production may not be economically feasible. Among the practices that can increase production are applying fertilizer, spreading water, thinning dense forests, seeding grasses and legumes, and converting forest sites to permanent dryland pasture.

Applications of fertilizer generally are limited to special seeded areas and to some meadows. An economic response is not always ensured, and test plots may be needed to determine the response. Applying fertilizer is not likely to be economical in most other areas of native forage.

Spreading water on meadows can increase forage production in some areas. On meadows that dry out early, this practice can prolong the growing season and improve the quality of the forage.

Heavy thinning of dense forest increases the amount of light that reaches the understory. It improves the growth of understory plants, especially native grasses, and permits stagnated timber stands to increase their growth rate. The response of forage to thinning is temporary if the canopy is allowed to close. It varies, depending on the site, and the economic advantage of applying this practice should be considered on a site-by-site basis. Thinning mixed stands of Douglas fir and ponderosa pine or of ponderosa pine and oak results in the greatest natural increase in forage production.

On some recently burned sites, seeding suitable species of grasses and legumes results in the establishment of good stands of forage. In forested areas these stands may deteriorate after several years if brush fields develop and take over the sites; however, at some study locations in the survey area, such seedings have retarded the return of brush following a fire. Care is advised in the seeding of burned areas that were formerly oak-savanna areas, grassland, or idle fields. If these areas supported weedy stands of annual forbs and grasses before burning, weed control probably is needed if seeding is to be successful.

Forage species are seeded in some areas of oak, pine, or grassland after the sites have been prepared by methods other than burning. Clearing brush, farming, applying herbicides, and using a range drill are techniques that are employed at times to improve the site. The economical value of seeding forage species has a great bearing on the feasibility of seeding a particular site. The species seeded and the seeding methods used should be restricted to those that local experience has shown to be successful on the soils and sites involved.

After forested areas are logged, seeding along forest roads, on landings, and in other critical areas is nearly always successful if proper seeding methods are used. In some areas the purpose of seeding is both erosion

control and forage production. Care is needed to ensure that the species selected for seeding and the seeding rates are those that achieve the management objective and that are adapted to the local environment. Seedings in tree-regeneration areas generally should be light. Seeding nonaggressive species that do not form sod helps to control competition with tree seedlings. Roadways and other areas that have been cut and filled should be stabilized by seeding aggressive species at heavy rates.

Most forested sites that are steeply sloping or are characterized by soils that formed in material derived from granitic rock, except those at the highest elevations, can be converted to permanent dryland pasture if forest management is not the long-term objective. Land that is removed from forest production can produce a wide variety of improved forage species. Yields of forage on these sites may be 3 to 5 times greater than those in the former natural stands.

Proper grazing use.—A proper degree of grazing use is achieved when the percentage, on a dry-weight basis, of the total annual production of the key species planned for grazing is not excessive. The percentage of forage removed in any one season is limited to that which is consistent with the physiological limitations of the plants. Proper grazing use is related to the objectives of specific land users. Other factors to be considered are the amount of residual growth needed to provide habitat for wildlife and the amount of stubble and litter needed to protect the soils.

When the degree of use is planned, the grazing pressure that plants can withstand and still make adequate recovery should be considered. The degree of use can be greater in the dormant season, when forage species are more tolerant of grazing, than during the growing season.

Management objectives may further restrict the degree of use. For example, grazing plans for riparian areas may allow very limited use of willow or aspen when these species are critical to site improvement. Grazing objectives in a forest plantation may require heavy use of the key forage grasses to reduce their competition with tree seedlings for moisture or to reduce the risk of fire.

Water availability.—Because the distribution of grazing is closely associated with the location of livestock watering facilities, the availability of water is an important management concern. The distribution of livestock and the use of forage can be controlled by improving the water supply through the development of springs, ponds, wells, or pipelines. The watering facilities can be 1.5 to 2.0 miles apart on some grazing sites that are gently sloping and readily accessible. The facilities should be more closely spaced, however, on some sites where access is poor or the topography is rough. Many areas near water sources are overgrazed. Where overgrazing is a concern, adjustments in the grazing program should be considered.

Grazing systems.—A grazing system is the planned sequence and timing of grazing in an area. The sequence commonly is planned for as long as 5 years. Yearly modifications in the plan can be made in response to changes in the growing season, economic conditions, or other management considerations. Planned grazing systems are important in accomplishing management objectives and are applicable to all kinds of grazing land. If the system is to work well, some flexibility is needed in making the adjustments required because of changes in livestock needs, weather, the availability of water, and the amount or kind of available forage.

A grazing system is used to achieve proper use of the key forage species and proper timing of the grazing. It promotes more efficient use of the entire area being grazed. It also allows grazing and rest periods to be scheduled over a period of years, or only for a year, in response to changes in forage quality, variations in the season of use on different sites, and the long-term physiological requirements of the plants. A special function of grazing systems is to allow coordination of grazing periods with other management activities, such as logging, seeding, breeding, and calf weaning.

Fencing.—Proper control of cattle is not feasible unless grazing units or pastures are correctly designed. It is achieved by selecting a pasture size according to such factors as the size of the herd, the type of forage available, the topography, and the boundaries of the vegetative site. In some areas natural barriers reduce the amount of fencing required. Fencing can separate highly contrasting areas. For example, they can separate areas of wet, clayey soils from areas of well drained soils. Sites that differ considerably in their season of use should be divided if feasible. For example, moist, north-facing slopes should be divided from dry, south-facing slopes, and areas at low elevations should be divided from areas at high elevations. Cross-fencing is useful in separating seeded areas or meadows from other areas and in reducing the size of large pastures.

Fences should be located along routes that permit construction and maintenance costs to be minimized and allow management objectives to be met. Careful planning is needed to avoid conflicts with other uses, such as timber production and recreation.

Deferred grazing.—This is the practice of delaying grazing either until the dormant season or until the growth cycle and seed production of the key species are completed. It allows the plants enough time to

recover from the previous years of grazing and to develop ripe seed, which is needed if new seedlings are to be established. Deferred grazing can be scheduled periodically over several years. When incorporated into a grazing system, it can be applied on a set of pastures over several years so that some or all of the pastures receive this treatment.

Rest periods.—Resting pastures, either for a full season or for a longer period, is sometimes necessary. The grazing system may provide for the total rest of some pastures for special purposes. Examples of these purposes are allowing protective litter to build up, reserving forage to meet wildlife needs, permitting seedlings to become established, allowing riparian habitat to recover, allowing recovery following a fire, and providing short-term protection of plantations. Livestock should be excluded for long periods in some areas, such as those where erosion is an important concern.

Vegetative Zones and Sites

By Gene Hickman, range conservationist, Soil Conservation Service.

This survey area is in the center of a region of great environmental diversity. The unique broad patterns of vegetation in the area are characterized as vegetative zones *(5)*. This region has a greater diversity of forest plant communities that grow in a more complex pattern than any comparable area in the western part of the United States *(31)*.

The major regional climatic variations within the survey area extend both from north to south and from east to west. These variations, as influenced by the geologic and topographic variations typical of the area, result in unique soil-vegetation relationships. The characteristics of the vegetative sites identified in this survey area reflect variations in climate, geology, and topography.

The vegetative sites occur on the landscape in combinations and positions that are predictable and are repeated throughout a given area of similar soils and macroclimate. Geographic areas that have a significantly different macroclimate represent different vegetative zones that are made up of different vegetative sites or different combinations of sites. Consequently, soil-vegetation relationships within the survey area are much better understood if they are related to the major geographic areas.

Vegetative Zones

This section describes the vegetative zones in the survey area and identifies the general soil map units that are included in each zone.

Vegetative zone 1. This zone includes general soil map units 1, 2, 3, and 4. The soils in this zone are in the driest and warmest parts of the survey area. The temperature varies considerably from one season to another. The mean annual precipitation ranges from about 18 inches to 24 inches.

Although farming and urban development have permanently changed much of the former plant cover in this zone, sizable stands of native vegetation remain. The native plant cover grows in areas of open grassland or slowly growing Oregon white oak-ponderosa pine savanna. The soils in most of these areas are shallow, droughty, or clayey. In some areas, however, they are deep, well drained, and loamy and support dense stands of rapidly growing ponderosa pine, mixed oak, and Pacific madrone. The climate generally is too dry for Douglas fir, although minor amounts grow in favorable locations. The soils on flood plains and the very poorly drained soils on terraces are very productive. They support meadow vegetation or dense mixtures of cottonwood and other deciduous trees and shrubs.

Vegetative zone 2. This zone includes general soil map units 5, 11, 13, and 20. It is on mountains at low elevations and in areas adjacent to valley terraces and flood plains. Elevation typically is less than 4,000 feet, and the mean annual precipitation is about 24 to 35 inches.

The vegetation in this zone is mainly Douglas fir and ponderosa pine. Pacific madrone and California black oak are common. Interspersed throughout the zone are shallow, droughty, or clayey soils that support grasses, shrubs, or mixed stands of oak and ponderosa pine. Hot, dry summers, which are typical in this zone, contribute to long periods of high moisture stress and to the mortality of tree seedlings *(28)*.

Vegetative zone 3. This zone includes general soil map units 6, 19, and 21. It is at low elevations on mountains. Elevation typically is less than 4,000 feet, and the mean annual precipitation is about 35 to 50 inches.

The vegetation in this zone is dominated by Douglas fir and a complex, diverse understory. California black oak, Pacific madrone, canyon live oak, and sugar pine are common in much of the zone. White fir is of minor extent or does not occur in most stands. It is more common on north-facing slopes at elevations of about 3,000 feet than in other areas.

Vegetative zone 4. This zone includes general soil map units 7, 9, and 18. It is in the most moist geographic area. Such species as Pacific

rhododendron, salal, red huckleberry, red alder, and western hemlock are characteristic of this zone. The mean annual precipitation is about 40 to 60 inches.

The vegetation in this zone is dominated by Douglas fir. The understory is characterized by a dense cover of salal and western swordfern. Areas on north-facing slopes and along drainageways support a small amount of western hemlock.

Vegetative zone 5. This zone includes general soil map units 8, 10, 22, and 23. It is at low elevations in the Cascade Mountains. The mean annual precipitation is about 35 to 50 inches.

The vegetation in this zone is dominated by white fir and Douglas fir. Ponderosa pine, sugar pine, California black oak, and Pacific madrone are important species. Small meadows in areas of poorly drained soils are interspersed throughout this zone.

Vegetative zone 6. This zone includes general soil map units 24 and 25. It supports plants that are transitional between those of the forest communities on the western flank of the Cascade Mountains and those of the plant communities in the central part of Oregon. The mean annual precipitation is about 25 to 35 inches. Winters are cold.

The main vegetation in this zone is a mixed conifer forest characterized by ponderosa pine, sugar pine, incense cedar, Douglas fir, and white fir interspersed with small ponderosa pine forests, juniper scabland, sagebrush flats, and meadows. The plant communities associated with this zone include fewer understory species than those on the western flank of the Cascade Mountains.

Vegetative zone 7. This zone includes general soil map units 12 and 26. It is along the watershed of the Klamath River, near the California-Oregon State line. This zone is on the low-elevation edge of the Cascade Mountains. The climate and plant communities are transitional to those east of those mountains.

The species that commonly grow farther east in Oregon, such as antelope bitterbrush, rabbitbrush, and western juniper, are abundant in this zone. Noticeably absent from the plant communities are plants that are common to the western part of Oregon, such as Pacific madrone, whiteleaf manzanita, and poison oak.

Vegetative zone 8. This zone is in the summit area of the southern extension of the Cascade Mountains. It consists of three distinct climatic areas that are typical of cold, high-elevation snow zones.

The first of these climatic areas includes general soil map unit 16. The vegetative sites in this area are dominated by pure stands of white fir on north-facing slopes and in nearly level areas. White fir, Douglas fir, and incense cedar grow on south-facing slopes. Understory species are few and are sparsely distributed. White pine and Shasta red fir, which commonly grow on cold sites at high elevations, are not evident.

The second climatic area includes general soil map units 14 and 17. The vegetative sites in this area are dominated by stands of white fir and Douglas fir. The sites are interspersed with meadows and stands of lodgepole pine in cold depressions. Also, they support an abundance of Pacific yew and stunted chinkapin and sporadic white pine and Shasta red fir. This area has gained attention in recent decades as a major problem area for tree regeneration and forest management *(12)*.

The third climatic area in this zone includes general soil map unit 15. The vegetative sites in this area are dominated by white fir or Shasta red fir, or both, and varying amounts of white pine. Douglas fir is common only on south-facing slopes, and the growth of ponderosa pine is sporadic. The area is interspersed with meadows and lodgepole pine in cold depressions. Understory species are numerous and are abundant.

Vegetative Sites

This section describes the vegetative sites in the survey area. The descriptions specify the potential natural plant community for each site, the variations in plant growth and species on the site, associated sites, and management of the site and its response to disturbance.

Biscuit-Scabland (intermound), 18- to 26-inch precipitation zone. The potential plant community on this site is dominated by forbs and grasses, such as annual hairgrass, Canada bluegrass, spikerush, mouse barley, and Pacific foxtail. Forbs include bicolor lupine, dowingia, poverty clover, tomcat clover, nakedstem broomrape, wooly meadowfoam, and brodiaea.

Site variation.—Plant growth and the kind of species vary considerably from place to place, depending on the degree of wetness and the soil depth.

Associated sites.—The site Biscuit-Scabland (mound), 18- to 26-inch precipitation zone, is on mounds in areas of patterned ground. Areas of the deeper soils include the sites Loamy Shrub Scabland, 18- to 35-inch precipitation zone; Loamy Hills, 20- to 35-inch precipitation zone; and Droughty Slopes, 20- to 30-inch precipitation zone.

Management and response to disturbance.—The more palatable forage plants include Canada bluegrass, annual hairgrass, and mouse barley, but these plants commonly are sparse or do not grow in all areas of the

site. The annual grasses and forbs that invade the site include soft chess, medusahead wildrye, hedgehog dogtail, and tarweed. Livestock grazing is minimal on this site. Grazing management decisions normally are the same as those for the adjacent mound areas, which are the primary grazing areas.

Biscuit-Scabland (mound), 18- to 26-inch precipitation zone. The potential plant community on this site is dominated by bluebunch wheatgrass. Other grasses include Lemmon needlegrass, pine bluegrass, Idaho fescue, and California brome. Wedgeleaf ceanothus is the only shrub that is potentially of significant extent. It may be included on the site in response to fires in the past. Forbs include lomatium, wooly eriophyllum, bicolor lupine, western buttercup, western yarrow, woodlandstar, and purplehead brodioea.

Site variation.—Western juniper occasionally grows in the drainage area of the Klamath River.

Associated sites.—The site Biscuit-Scabland (intermound), 18- to 26-inch precipitation zone, is in areas where soil depth is limited. The site Loamy Hills, 20- to 35-inch precipitation zone, is in some areas. The site Poorly Drained Bottom is in basins, in drainageways, and between mounds in areas of patterned ground in the valley of Bear Creek. The site Droughty Fan, 18- to 26-inch precipitation zone, is in areas where the soils are clayey. The sites Droughty Slopes, 20- to 30-inch precipitation zone, and Loamy Shrub Scabland, 18- to 35-inch precipitation zone, are in the drainage areas of the Klamath River where the soils are clayey or soil depth is limited.

Management and response to disturbance.—The more palatable forage plants include bluebunch wheatgrass, Lemmon needlegrass, pine bluegrass, and Idaho fescue. Overgrazing results in a decrease in the abundance of the more palatable forage plants and an increase in the abundance of annual grasses and forbs. Annual grasses include annual fescue, soft chess, medusahead wildrye, ripgut brome, and cheatgrass. Common forbs that increase in abundance or invade are filaree, bicolor lupine, popcornflower, lomatium, and cornsalad. Range seeding is impractical in most places because of the many intermound areas, which restrict the movement of ground equipment.

Clayey Hills, 20- to 35-inch precipitation zone. The potential plant community of this site is dominated by Oregon white oak and scattered ponderosa pine and California black oak. Shrubs include Pacific serviceberry, poison oak, and hairy honeysuckle. The understory is dominated by a dense stand of California oatgrass. Other grasses include Idaho fescue, Canada bluegrass, pine bluegrass, prairie junegrass, California brome, and blue wildrye. Forbs include western buttercup, carrotleaved horkelia, western yarrow, brodiaea, yampa, and fawnlily.

Site variation.—Concave areas and areas near drainageways support more Canada bluegrass and may support less Oregon white oak. Areas on north-facing slopes and areas that receive a greater amount of precipitation commonly support much more ponderosa pine and California black oak and less Oregon white oak.

Associated sites.—The site Loamy Shrub Scabland, 18- to 35-inch precipitation zone, is in areas where soil depth is limited. The sites Douglas Fir Forest and Pine-Douglas Fir-Fescue are in areas where the Clayey Hills site is adjacent to timbered areas. The sites Loamy Hills, 20- to 35-inch precipitation zone, and Droughty North, 18- to 35-inch precipitation zone, are in some areas.

Management and response to disturbance.—The more palatable forage plants include California oatgrass, Idaho fescue, Canada bluegrass, and pine bluegrass. Overgrazing results in a decrease in the abundance of the more preferred forage species, which gradually are replaced by native forbs and invader grasses and forbs. The dominant invader grasses include medusahead wildrye, ripgut brome, sterile brome, hedgehog dogtail, and wild oat. The forbs that invade include starthistle, prickly lettuce, Klamath weed, fiddleneck, and tarweed. Poison oak moderately increases in abundance following a disturbance or decline in the ecological condition. If the oak is cut or burned, it will sprout and become reestablished on the site.

Claypan, 14- to 18-inch precipitation zone. The potential plant community of this site is dominated by Idaho fescue and low sagebrush. Sandberg bluegrass and bluebunch wheatgrass and minor amounts of prairie junegrass, Thurber needlegrass, bottlebrush squirreltail, and sedge also grow on the site. Forbs include wooly eriophyllum, shrubby buckwheat, snow eriogonum, clover, phlox, and yampa. Shrubs include not only low sagebrush but also antelope bitterbrush.

Site variation.—In some areas scattered western juniper or ponderosa pine grow on this site.

Associated sites.—The sites Intermittent Swale and Loamy Juniper Scabland, 20- to 30-inch precipitation zone, are in some areas. The sites Douglas Fir-Mixed Pine-Sedge Forest and Ponderosa Pine-Fescue are in areas adjacent to forest land.

Management and response to disturbance.—The more palatable forage plants include Idaho fescue,

bluebunch wheatgrass, and Sandberg bluegrass. Overgrazing results in a decrease in the abundance of Idaho fescue and bluebunch wheatgrass and an increase in the abundance of Sandberg bluegrass and bottlebrush squirreltail. Annual grasses and forbs, such as cheatgrass, annual brome, knotweed, birdbeak, and hemizonia, invade areas where the site has deteriorated.

Deep Loamy, 16- to 20-inch precipitation zone. The potential plant community on this site is dominated by ponderosa pine, which commonly regenerates in clumps and under openings in the canopy. The dominant understory shrub is antelope bitterbrush, but the site supports minor amounts of Pacific serviceberry, big sagebrush, desert gooseberry, green rabbitbrush, and Klamath plum. Grasses and grasslike plants are dominated by Idaho fescue but include bluebunch wheatgrass, Sandberg bluegrass, Ross sedge, prairie junegrass, and western needlegrass. Forbs include western yarrow, pearly everlasting, wooly eriophyllum, lomatium, lupine, and arrowleaf balsamroot.

Associated sites.—The sites Mixed Conifer-Chinkapin-Sedge Forest and Mixed Conifer-Bitterbrush-Sedge Forest are in areas that are colder and receive a greater amount of precipitation. The site Ponderosa Pine-Fescue is in areas that receive a greater amount of precipitation. The site Wet Meadow is in basins and near drainageways.

Management and response to disturbance.—The more palatable forage plants include Idaho fescue, Ross sedge, bluebunch wheatgrass, and western needlegrass. If the site is grazed in the fall, they also include antelope bitterbrush. Overgrazing for prolonged periods results in a decrease in the abundance of Idaho fescue, bluebunch wheatgrass, and antelope bitterbrush and can hinder tree reproduction. Needlegrass, squirreltail, big sagebrush, and green rabbitbrush may increase in abundance where lighting is adequate. Changes in plant composition generally are influenced by surface disturbance, canopy removal, and competition among species for moisture and light.

Ground fires or logging can increase the potential for grass production, temporarily reduce the abundance of antelope bitterbrush, and thin out young stands of pine. If openings are created in the canopy, grasses and antelope bitterbrush can become more abundant in response to the increased amount of light. Pine regenerates in new openings after burning and in some areas forms dense, stagnated stands that require thinning. As the overstory closes, the increased shade thins out light-dependent grasses and greatly reduces the abundance of antelope bitterbrush.

Deep Loamy Terrace, 18- to 28-inch precipitation zone. The potential plant community on this site is dominated by ponderosa pine, California black oak, Oregon white oak, and Pacific madrone. Small amounts of incense cedar and Douglas fir are in some areas. Understory shrubs include an abundance of common snowberry. They also include Pacific serviceberry, tall Oregon grape, poison oak, creambush oceanspray, and hairy honeysuckle. Grasses are sparse. They include Idaho fescue, California brome, blue wildrye, and pine bluegrass. Forbs include giant fawnlily, beauty cinquefoil, mountain sweetroot, horsetail, and lupine.

Site variation.—Some nearly level areas near drainageways support Oregon ash and black hawthorn.

Associated sites.—The site Loamy Flood Plain, 18- to 30-inch precipitation zone, is in areas near drainageways that are subject to flooding. The site Poorly Drained Bottom also is in areas near drainageways. The site Pine-Douglas Fir-Fescue is on alluvial fans and in upland areas where the soils are well drained. The sites Loamy Hills, 20- to 35-inch precipitation zone, and Loamy Slopes, 18- to 24-inch precipitation zone, are in upland areas where the soils are well drained and soil depth is limited.

Management and response to disturbance.—The more palatable forage grasses include Idaho fescue, pine bluegrass, and California brome. Many areas have been cleared and are used for crop production. Overgrazing results in a decrease in the abundance of the more palatable forage plants but has little effect on the total plant composition. Competition for light is the dominant factor affecting adjustments in the understory cover in areas that are grazed.

Light removal of ponderosa pine permits the hardwood overstory to expand and the understory grasses temporarily to increase in abundance. Complete removal of the overstory results in expansion of the herbaceous cover and vigorous sprouting of oak and madrone. Ponderosa pine may regenerate, particularly in areas where there has been some burning or surface disturbance. Severe disturbance of the surface or burning results in the invasion of whiteleaf manzanita and Kentucky bluegrass and the vigorous sprouting of hardwood trees. Blackberry also may invade the site.

Douglas Fir Forest. The potential plant community on this site is dominated by Douglas fir. Some areas support small amounts of other coniferous trees, including incense cedar, ponderosa pine, and sugar pine. Hardwoods are common in the overstory. They include Pacific madrone and California black oak. The midstory is dominated by trees and tall shrubs, such as creambush oceanspray, Pacific serviceberry, California

hazel, and deerbrush. Understory shrubs include common snowberry, poison oak, tall Oregon grape, trailing blackberry, baldhip rose, thimbleberry, and hairy honeysuckle. Important species in the grass cover, which is sparse, include western fescue, mountain brome, tall trisetum, and blue wildrye. Forbs include starflower, strawberry, western swordfern, Hooker fairybells, California vetch, white hawkweed, and tarweed.

Site variation.—Canyon live oak commonly grows in areas of this site in the western part of the survey area. Sugar pine commonly grows in areas where the soils formed in material derived from granitic rock. In the Siskiyou Mountains, onsite investigation may be needed to distinguish this site from the sites Loamy Hills, 20- to 35-inch precipitation zone, and Droughty North, 18- to 35-inch precipitation zone.

Associated sites.—The site Droughty North, 18- to 35-inch precipitation zone, is in some areas. The site Pine-Douglas Fir-Fescue is in nearly level areas and on south-facing slopes. The site Mixed Pine-Douglas Fir-Fescue Forest, Granitic, is in areas of soils that formed in material derived from granite. It is in nearly level areas and on south-facing slopes.

Management and response to disturbance.—The more palatable forage plants include western fescue, mountain brome, tall trisetum, creambush oceanspray, deerbrush, and Pacific serviceberry.

Clearcutting or severe burning results in the development of dense stands of brush that are dominated by deerbrush and whiteleaf manzanita and by sprouted Pacific madrone and California black oak. Other aggressive shrubs include Pacific serviceberry, tall Oregon grape, common snowberry, poison oak, and hairy honeysuckle. Where there is no Douglas fir overstory, most of the grasses and forbs that require much light increase considerably in abundance and ponderosa pine is most likely to regenerate.

The hardwoods eventually form a canopy that dominates the brush fields. As new stands develop, however, the hardwoods and the brush fields are suppressed and then are overtopped by the conifers. A dense overstory of pole-sized Douglas fir commonly develops. The dense overstory reduces the abundance of Pacific madrone and oak and drastically reduces the abundance of understory species. As the stand matures or after selective logging, the understory increases in abundance in response to the increased penetration of light through the canopy.

Douglas Fir-Beargrass Forest, Serpentine. The potential plant community on this site is dominated by Douglas fir and lesser amounts of incense cedar. Other less common coniferous trees include sugar pine, and Jeffrey pine. In a few areas, they also include Pacific yew. Pacific madrone is the most common overstory hardwood; however, golden chinkapin is in some stands. The understory commonly includes shrub-sized canyon live oak and shrubs, such as creambush oceanspray, woodland phlox, baldhip rose, cascade Oregongrape, Whipplevine, and pinemat manzanita. Grasses and grasslike plants include California fescue, western fescue, Alaska oniongrass, crinkleawn fescue, and common beargrass. Forbs include Henderson fawnlily, Nuttal peavine, white hawkweed, spring queen, hillside reinorchid, western swordfern, and Indian dream fern.

Site variation.—Areas on south-facing slopes support a more open overstory and a greater abundance of understory species, such as common beargrass, California fescue, and canyon live oak. Jeffrey pine grows mainly on south-facing slopes.

Associated sites.—The site Mixed Fir-Salal (rhododendron) Forest is in areas on north-facing slopes where the soils are not influenced by serpentine. The site Douglas Fir-Madrone-Chinkapin Forest is in areas on south-facing slopes where the soils are not influenced by serpentine.

Management and response to disturbance.—The more palatable forage plants include western fescue, Alaska oniongrass, crinkleawn fescue, and creambush oceanspray. Logging or burning generally results in an increase in the abundance of low-value, unpalatable species, such as California fescue, common beargrass, Whipplevine, canyon live oak, and greenleaf manzanita. Brush fields may be dense enough to restrict access by livestock.

Heavy logging or burning results in an increase in the abundance of sprouting shrubs and trees, such as Pacific madrone and canyon live oak, and in some regeneration of incense cedar and Jeffrey pine. Other species that rapidly increase in abundance under such conditions include common beargrass, western fescue, creambush oceanspray, Whipplevine, greenleaf manzanita, and white hawkweed.

Douglas Fir-Black Oak Forest. The potential plant community on this site is dominated by Douglas fir. Ponderosa pine and sugar pine are common in the overstory. Incense cedar grows only in some areas. The prominent overstory hardwood trees include California black oak and Pacific madrone. The understory includes scattered canyon live oak and a few stunted white fir and golden chinkapin. Understory shrubs include deerbrush, creambush oceanspray, California hazel, common snowberry, tall Oregon grape, and western princes pine. Grasses include western fescue, mountain brome, California fescue, and crinkleawn fescue. Forbs

include iris, strawberry, brackenfern, white hawkweed, and tarweed.

Site variation.—Tanoak and evergreen huckleberry grow in some areas of this site in the western part of the survey area. Canyon live oak generally does not grow in the eastern part of this site's range.

Associated sites.—The site Douglas Fir-Chinkapin Forest is on north-facing slopes. The site Douglas Fir-Pine Forest, Serpentine, is in areas that are influenced by serpentine.

Management and response to disturbance.—The more palatable forage plants include western fescue, mountain brome, crinkleawn fescue, and deerbrush. Grazing pressure is greatest in the open areas, where these plants are most common.

Clearcutting or burning usually is followed by the development of dense stands of shrubs, such as deerbrush, creambush oceanspray, common snowberry, Whipplevine, California hazel, hairy honeysuckle, poison oak, tall Oregon grape, and hoary manzanita. Sprouting hardwood trees recover rapidly. As a result, Pacific madrone and California black oak can dominate new stands. Ponderosa pine regenerates most readily at this early stage of succession, when more light is available. Douglas fir regenerates slowly, but it eventually emerges through the canopy of shrubs and hardwood trees and regains dominance of the site.

Selective logging, the less severe burns, or local disturbances result in varied plant responses, depending on the species removed, the degree of cutting or burning, and the extent of surface disturbance. As more light becomes available, suppressed understory plants begin to grow and such species as ponderosa pine, deerbrush, common snowberry, and most grasses increase in abundance.

Douglas Fir-Chinkapin Forest. The potential plant community on this site is dominated by Douglas fir and minor amounts of other conifers, such as sugar pine, ponderosa pine, and incense cedar. In addition to golden chinkapin, the hardwood trees on this site include Pacific madrone, California black oak, Pacific dogwood, and canyon live oak. Understory shrubs include cascade Oregongrape, Whipplevine, western princes pine, American twinflower, California hazel, and creambush oceanspray. The grass cover, which is sparse, includes western fescue, mountain brome, Alaska oniongrass, and crinkleawn fescue. Common forbs include deerfoot vanillaleaf, insideout flower, brackenfern, and white hawkweed.

Site variation.—Canyon live oak commonly does not grow in most areas in the eastern part of this site's range. White fir and salal grow in some areas that are at an elevation of more than 3,000 feet or that receive a greater amount of precipitation.

Associated sites.—The site Douglas Fir-Black Oak Forest is on south-facing slopes. The site Douglas Fir-Pine Forest, Serpentine, is in areas that are influenced by serpentine.

Management and response to disturbance.—The more palatable forage plants include western fescue, mountain brome, Alaska oniongrass, crinkleawn fescue, and deerbrush. Forage production in typical middle-aged or old-growth stands is moderate or low in all areas, except for openings that receive much light.

Clearcutting or burning generally is followed by the development of dense stands of shrubs, such as deerbrush, California hazel, creambush oceanspray, common snowberry, Whipplevine, hairy manzanita, and poison oak. Sprouting hardwood trees recover rapidly. As a result, Pacific madrone, California black oak, and golden chinkapin can dominate new stands. Ponderosa pine generally regenerates only in minor amounts, but regeneration is most likely at this early stage, when the maximum amount of light is available. Douglas fir regenerates slowly, but it eventually emerges through the canopy of shrubs and hardwood trees and regains dominance of the site.

Selective logging or local disturbances in normal stands permit suppressed species to grow as more light becomes available. The species that have low tolerance to light, such as deerfoot vanillaleaf, may decrease in abundance.

Douglas Fir-Dogwood Forest, Granitic. The potential plant community on this site is dominated by Douglas fir and some sugar pine. Other coniferous trees, which occur in small amounts, include incense cedar and ponderosa pine. Common overstory hardwoods include Pacific madrone and California black oak. The midstory includes regenerated conifers and Pacific dogwood. Understory shrubs include creambush oceanspray, California hazel, common snowberry, poison oak, baldhip rose, deerbrush, and hairy honeysuckle. Grasses include western fescue, mountain brome, and California fescue. Forbs, which are sparse, include tarweed, starflower, California bellflower, brackenfern, white hawkweed, western swordfern, and mountain sweetroot.

Site variation.—Some areas at the higher elevations and areas where more moisture is available support scattered white fir, golden chinkapin, cascade Oregongrape, deerfoot vanillaleaf, common beargrass, arnica, and American twinflower.

Associated sites.—The site Douglas Fir-Black Oak Forest is on south-facing slopes at elevations of less than 3,000 feet. The site Douglas Fir-Madrone-

Chinkapin Forest is on south-facing slopes at elevations of more than about 3,000 feet. The site Douglas Fir-Chinkapin Forest is in areas on north-facing slopes where the soils did not form in material derived from granite.

Management and response to disturbance.—The more palatable forage plants include mountain brome, western fescue, and deerbrush. Because of a high hazard of erosion on the soils in areas of this site, the steeper slopes should not be grazed.

Clearcutting or burning results in the development of dense stands of brush, such as sprouted Pacific madrone and California black oak, and shrubs, such as deerbrush, creambush oceanspray, whiteleaf manzanita, common snowberry, thimbleberry, and poison oak. Grasses and forbs that require much light become more abundant in open areas created by logging and burning. Ponderosa pine is most likely to regenerate when there is less conifer overstory and more available light. Later, as the new stand develops, hardwood trees and shrubs are overtopped and suppressed by Douglas fir. As the stand matures or after selective logging, the understory composition gradually changes in response to significant changes in light intensity.

Douglas Fir-Madrone-Chinkapin Forest. The potential plant community on this site is dominated by Douglas fir and some white fir and incense cedar. Small amounts of sugar pine and western hemlock are in some areas. The main hardwood trees in the overstory are Pacific madrone and minor amounts of golden chinkapin and Pacific dogwood. Common understory shrubs are cascade Oregongrape, common snowberry, baldhip rose, California hazel, creambush oceanspray, western princes pine, trailing blackberry, Whipplevine, and American twinflower. The grass cover, which is sparse, includes western fescue, mountain brome, and crinkleawn fescue. The prominent forbs include brackenfern, strawberry, deerfoot vanillaleaf, starflower, mountain sweetroot, western swordfern, and white hawkweed.

Associated sites.—The site Mixed Fir-Salal (rhododendron) Forest is on north-facing slopes and in concave areas. The site Douglas Fir-Black Oak Forest is in areas that receive a smaller amount of precipitation and at elevations of more than about 3,000 feet. The sites Douglas Fir-Beargrass Forest, Serpentine, and Douglas Fir-Pine Forest, Serpentine, are in areas where the soils are influenced by serpentine.

Management and response to disturbance.—The more palatable forage plants include western fescue, mountain brome, Alaska oniongrass, and creambush oceanspray. The amount of forage is greater in areas that have been opened by disturbances, such as logging and burning; however, some areas that have been heavily thinned or clearcut support an abundance of unpalatable evergreen species, such as Pacific madrone, cascade Oregongrape, snowbrush, manzanita, and golden chinkapin. These brush fields may be dense enough to restrict access by livestock. Because of a high hazard of erosion on the soils in areas of this site, which formed in material derived from granitic rock or schist, the steeper slopes should not be grazed.

Clearcutting or burning results in the development of dense stands of brush that include native shrubs, such as creambush oceanspray, California hazel, common snowberry, baldhip rose, trailing blackberry, and Whipplevine. Invaders, such as snowbrush, hoary manzanita, and greenleaf manzanita, are common in some areas. Pacific madrone and golden chinkapin sprout rapidly and compete well with the shrubs. In addition to shrubs, some grasses and light-tolerant forbs become more abundant in open areas.

Douglas Fir-Mixed Pine-Fescue Forest. The potential plant community on this site is dominated by Douglas fir. Sugar pine is abundant, and some ponderosa pine and incense cedar are in the stands. Common hardwood trees in the overstory are Pacific madrone and California black oak. The midstory is characterized by regenerated trees and tall shrubs, such as deerbrush, creambush oceanspray, Pacific serviceberry, and California hazel. Understory shrubs include common snowberry, poison oak, wild rose, tall Oregon grape, Whipplevine, western princes pine, and hairy honeysuckle. Grasses include western fescue, blue wildrye, mountain brome, tall trisetum, and California fescue. Forbs include California vetch, brackenfern, Henderson fawnlily, California tea, strawberry, California bellflower, white hawkweed, and Hooker fairybells.

Site variation.—Canyon live oak grows in some areas of this site in the western part of the survey area. Areas where the amount of precipitation is lowest, such as those along the Applegate River and its tributaries, support stands that are dominated by ponderosa pine or Oregon white oak.

Associated sites.—The site Pine-Douglas Fir-Fescue is on south-facing slopes. The site Douglas Fir Forest is on north-facing slopes. The site Droughty North, 18- to 35-inch precipitation zone, is in some areas.

Management and response to disturbance.—The more palatable forage plants include mountain brome, tall trisetum, western fescue, and deerbrush. Because of a high hazard of erosion on the soils in areas of this site, which formed in material derived from granitic rock,

the steeper slopes should not be grazed.

Clearcutting or burning results in the development of dense stands of brush dominated by deerbrush, whiteleaf manzanita and by Pacific madrone and California black oak. Other shrubs include Pacific serviceberry, Whipplevine, tall Oregon grape, common snowberry, poison oak, and hairy honeysuckle. Most of the native grasses and forbs that require much light increase considerably in abundance. Ponderosa pine is most likely to regenerate during periods when there is no Douglas fir overstory.

Eventually, hardwoods form a canopy that dominates the brush fields. As the new stand develops, however, the hardwoods and brush fields are suppressed and then are overtopped by conifers. A dense overstory of pole-sized Douglas fir generally develops. The dense overstory reduces the abundance of the Pacific madrone and oak cover and drastically reduces the abundance of understory species. Later, as the stand matures or after selective logging, the understory expands in response to the increased amount of light penetrating the canopy.

Douglas Fir-Mixed Pine-Sedge Forest. The potential plant community on this site is dominated by Douglas fir. Other conifers, such as ponderosa pine, sugar pine, and incense cedar, are less common but grow in nearly all areas. California black oak is the most common hardwood, but it does not grow in all stands. White fir, Oregon white oak, and western juniper grow only in a few stands. Understory shrubs include deerbrush, common snowberry, Pacific serviceberry, tall Oregon grape, wild rose, pachystima, squawcarpet, and western princes pine. Grasses include western fescue, tall trisetum, mountain brome, Orcutt brome, and Ross sedge. Forbs include white hawkweed, starflower, spreading dogbane, and California vetch.

Site variation.—Such species as California black oak, Oregon white oak, western juniper, ponderosa pine, and incense cedar are more abundant in areas that receive a smaller amount of precipitation and are warmer.

Associated sites.—The sites Loamy Slopes, 18- to 24-inch precipitation zone, and Loamy Juniper Scabland, 20- to 30-inch precipitation zone, are in areas where soil depth is limited. The site Mixed Conifer-Chinkapin-Sedge Forest is in areas that receive a greater amount of precipitation and are colder. The sites Droughty Slopes, 20- to 30-inch precipitation zone, and Loamy Shrub Scabland, 18- to 35-inch precipitation zone, are in areas of soils that receive a smaller amount of precipitation, are warmer, and have a limited depth. The site Wet Meadow is in basins and near drainageways.

Management and response to disturbance.—The more palatable forage plants include western fescue, mountain brome, Orcutt brome, and tall trisetum and shrubs, such as deerbrush and Pacific serviceberry.

Clearcutting or burning of the overstory results in the development of dense stands of brush, such as deerbrush, common snowberry, and Pacific serviceberry. Invading shrubs, such as greenleaf manzanita, snowbrush, and wedgeleaf ceanothus, also grow in these brush fields. Snowbrush is likely to grow only in the colder areas and wedgeleaf ceanothus only in the warmer areas. Regeneration of ponderosa pine and incense cedar results from logging or other disturbances that open the canopy. California black oak regenerates by sprouting soon after logging or burning.

Few herbaceous species invade the site following minor disturbances. After major surface disturbances, such species as cheatgrass, bottlebrush squirreltail, tarweed, and thistle may invade the site.

Douglas Fir-Pine Forest, Serpentine. The potential plant community on this site is dominated by Douglas fir and some incense cedar, Jeffrey pine, and sugar pine. The hardwoods on the site include Pacific madrone in the overstory and canyon live oak in the midstory. Understory shrubs, which are of minor extent, include creambush oceanspray, California hazel, common snowberry, Whipplevine, tall Oregon grape, and hairy honeysuckle. Grasses include California fescue, western fescue, California brome, and prairie junegrass. Forbs include western swordfern, Indian dream fern, iris, starflower, Nuttal peavine, and Henderson fawnlily.

Associated sites.—This site is adjacent to the sites Douglas Fir-Chinkapin Forest; Douglas Fir-Black Oak Forest; Mixed Fir-Salal (rhododendron) Forest; Douglas Fir-Beargrass Forest, Serpentine; and Douglas Fir-Madrone-Chinkapin Forest. The site Shallow Serpentine, 30- to 40-inch precipitation zone, is in areas where the soils are influenced by serpentine and soil depth is limited.

Management and response to disturbance.—The more palatable forage plants include western fescue, California brome, and prairie junegrass. Logging or burning generally results in stands of brush that include Whipplevine, creambush oceanspray, California hazel, and common snowberry. The shrubs that invade the site include hairy manzanita, greenleaf manzanita, and whiteleaf manzanita. They also include wedgeleaf ceanothus. Burning is followed by the sprouting of Pacific madrone and canyon live oak.

Droughty Fan, 18- to 26-inch precipitation zone. The potential plant community on this site is dominated by stands of Oregon white oak. California black oak

grows in some areas. In places it is nearly codominant with white oak. Ponderosa pine grows in some areas. Shrubs, which are sparse, include poison oak, Pacific serviceberry, and hairy honeysuckle. Idaho fescue may be codominant with bluebunch wheatgrass and California brome in the understory. Other grasses include blue wildrye, prairie junegrass, pine bluegrass, and Lemmon needlegrass. Forbs include lomatium, wooly eriophyllum, carrotleaved horkelia, western buttercup, and yampa.

Site variation.—The abundance of California black oak is greater in areas that receive a greater amount of precipitation or where the soils are deeper.

Associated sites.—The site Droughty Foothill Slopes, 18- to 22-inch precipitation zone, is on the steeper slopes. The site Semi-Wet Meadow is in areas of poorly drained soils. The site Poorly Drained Bottom is in areas of poorly drained soils near drainageways. The sites Clayey Hills, 20- to 35-inch precipitation zone, and Droughty North, 18- to 35-inch precipitation zone, are in the areas that receive the most precipitation. The sites Loamy Hills, 20- to 35-inch precipitation zone, and Loamy Slopes, 18- to 24-inch precipitation zone, are in areas of well drained soils that are not clayey.

Management and response to disturbance.—The more palatable forage plants on this site include Idaho fescue, bluebunch wheatgrass, California brome, and pine bluegrass; however, most areas are dominated by annual grasses and forbs. Overgrazing results in a decrease in the abundance of Idaho fescue and bluebunch wheatgrass. California brome, Lemmon needlegrass, and blue wildrye are native perennial grasses that increase in abundance when competition from other perennials is reduced. The annual grasses that invade deteriorated stands include medusahead wildrye, hedgehog dogtail, soft brome, sterile brome, ripgut brome, wild oat, and foxtail fescue. Forbs that invade deteriorated sites include star thistle, field hedge-parsley, tarweed, and willowweed. Poison oak invades under these conditions and in some areas develops into dense brush fields.

Cutting or burning results in the sprouting of Oregon white oak and California black oak and the eventual return of a deciduous tree canopy.

Droughty Foothill Slopes, 18- to 22-inch precipitation zone. The potential plant community on this site is dominated by bluebunch wheatgrass and Lemmon needlegrass. Other grasses include California brome, pine bluegrass, Idaho fescue, and prairie junegrass. Shrubs include Brewer lupine, northern buckwheat, and poison oak. Forbs include wooly eriophyllum, lomatium, woolyhead clover, hawksbeard, and California goldpoppy. Oregon white oak grows only in a few areas.

Associated sites.—The site Droughty North, 18- to 35-inch precipitation zone, is on north-facing slopes. The site Droughty Fan, 18- to 26-inch precipitation zone, is in the less sloping areas. The sites Loamy Slopes, 18- to 24-inch precipitation zone, and Loamy Hills, 20- to 35-inch precipitation zone, are in areas where the soils have a limited depth and are not clayey. The site Clayey Hills, 20- to 35-inch precipitation zone, is in concave areas and in areas that receive a greater amount of precipitation.

Management and response to disturbance.—The more palatable forage plants include bluebunch wheatgrass, Lemmon needlegrass, California brome, pine bluegrass, and Idaho fescue. Grazing by livestock in summer is limited because the temperatures usually are very warm. Most areas are dominated by annual grasses and forbs. Overgrazing results in a decrease in the abundance of the more palatable perennial grasses and an increase in the abundance of poison oak and annual grasses, such as medusahead wildrye, soft brome, cheatgrass, and hedgehog dogtail. Forbs, such as star thistle, filaree, willowweed, moth mullein, and tarweed, invade areas where the site is in poor condition. Success in reseeding these areas is limited by the hot, dry summers and severe competition from annual weeds.

Droughty North, 18- to 35-inch precipitation zone. The potential plant community on this site is dominated by Oregon white oak and birchleaf mountainmahogany. Small amounts of California black oak, ponderosa pine, and Douglas fir are in some areas. Shrubs, which are of minor extent, include Pacific serviceberry, tall Oregon grape, hairy honeysuckle, and poison oak. The understory is dominated by a dense stand of grasses, mainly Idaho fescue. Other grasses include prairie junegrass, California brome, pine bluegrass, and blue wildrye. Forbs include wooly eriophyllum, western yarrow, agoseris, brodiaea, and lomatium.

Site variation.—Birchleaf mountainmahogany is more abundant than oak at the higher elevations. At elevations of more than 3,500 feet, Oregon white oak is sparse or does not occur and the site is more commonly on south-facing slopes. Some areas along the Klamath River support western juniper. Poison oak does not grow in these areas, and whiteleaf manzanita does not invade or form brush fields following major disturbances. In the Siskiyou Mountains, onsite investigation may be needed to distinguish areas of this site from areas of the Douglas Fir Forest or Pine-Douglas Fir-Fescue sites.

Associated sites.—The site Douglas Fir Forest is in areas that receive a greater amount of precipitation or that are on north-facing slopes. The sites Loamy Hills, 20- to 35-inch precipitation zone, and Pine-Douglas Fir-Fescue are on south-facing slopes. The site Shallow Mountain Slopes, 22- to 30-inch precipitation zone, is on south-facing slopes where soil depth is limited. The site Droughty Foothill Slopes, 18- to 22-inch precipitation zone, is in some areas.

Management and response to disturbance.—The more palatable forage plants include Idaho fescue, pine bluegrass, prairie junegrass, and California brome. Overgrazing results in a decrease in the abundance of Idaho fescue and an increase in the abundance of blue wildrye, California brome, and Lemmon needlegrass. The annual grasses that invade the site include soft brome, cheatgrass, sterile brome, ripgut brome, and Pacific fescue. The native forbs that increase in abundance include wooly eriophyllum, western yarrow, and lomatium. The annual forbs that readily invade the site include tarweed, western snake-root, and filaree.

After severe burns, dense brush fields of whiteleaf manzanita, wedgeleaf ceanothus, and poison oak commonly develop. These brush fields suppress the understory vegetation and limit access by livestock. Burning or cutting of the white oak overstory initiates sprouting, which causes the oak to reoccupy the canopy. Birchleaf mountainmahogany does not sprout, and fire eliminates it from the site for many years.

The potential for converting this site from brush to suitable forage species is high, but conversion commonly is limited by the slope. The slope interferes with the use of ground equipment for site preparation and seeding; however, aerial broadcast seeding after burning or brush removal commonly is feasible, even on the steep slopes.

Droughty Slopes, 20- to 30-inch precipitation zone. The potential plant community on this site is dominated by Oregon white oak and scattered western juniper. Other trees, which occur in small amounts, include ponderosa pine and California black oak. Shrubs include Pacific serviceberry, wedgeleaf ceanothus, antelope bitterbrush, Klamath plum, shrubby buckwheat, and birchleaf mountainmahogany. Idaho fescue, bluebunch wheatgrass, and pine bluegrass are the most common grasses; however, small amounts of Lemmon needlegrass, prairie junegrass, and bottlebrush squirreltail also are on the site. Forbs include lomatium, wooly eriophyllum, western yarrow, filaree, yampa, brodiaea, and collomia.

Site variation.—Some of the less sloping areas and some concave areas support California oatgrass and ponderosa pine. California black oak rarely grows in areas where this site is east of the Klamath River.

Associated sites.—The site Douglas Fir-Mixed Pine-Sedge Forest is in areas where the soils are deeper or are lower in content of rock fragments. The sites Loamy Shrub Scabland, 18- to 35-inch precipitation zone, and Biscuit-Scabland (intermound), 18- to 26-inch precipitation zone, are in areas where soil depth is limited. The sites Biscuit-Scabland (mound), 18- to 26-inch precipitation zone, and Loamy Slopes, 18- to 24-inch precipitation zone, are in some areas.

Management and response to disturbance.—The more palatable forage plants include Idaho fescue, bluebunch wheatgrass, pine bluegrass, and prairie junegrass. If the site is grazed in the fall, they also include antelope bitterbrush. Overgrazing results in a decrease in the abundance of Idaho fescue, bluebunch wheatgrass, and antelope bitterbrush. In some areas, Lemmon needlegrass, pine bluegrass, and bottlebrush squirreltail increase in abundance and annual grasses and forbs, such as medusahead wildrye, cheatgrass, soft chess, tarweed, corn salad, Knotweed, and willowweed, invade.

Fire normally stimulates the growth of perennial bunchgrasses but results in a temporary decrease in the abundance of antelope bitterbrush and western juniper and a probable increase in the abundance of wedgeleaf ceanothus. Oregon white oak sprouts and rapidly reoccupies the site.

Intermittent Swale. The potential plant community on this site is dominated by Nevada bluegrass. Other grasses and grasslike plants include slender wheatgrass, meadow barley, Canby bluegrass, and sedge. Except for an occasional rose, rabbitbrush, or low sagebrush, the primary shrub is silver sagebrush. The site supports a variety of forbs, including mat muhly, penstemon, western yarrow, yampa, cinquefoil, brodiaea, and pearly everlasting, but these are only a minor part of the total composition.

Associated sites.—The site Claypan, 14- to 18-inch precipitation zone, is in some areas. The site Loamy Juniper Scabland, 20- to 30-inch precipitation zone, is in areas where soil depth is limited. The sites Douglas Fir-Mixed Pine-Sedge Forest and Ponderosa Pine-Fescue are in areas adjacent to forested sites.

Management and response to disturbance.—The more palatable forage plants include Nevada bluegrass, slender wheatgrass, meadow barley, and Canby bluegrass. Overgrazing results in a decrease in the abundance of the more palatable perennial grasses and an increase in the abundance of silver sagebrush. Annual forbs and grasses, such as willowweed, tarweed, brome, medusahead wildrye, and squirreltail, invade the site under these conditions. When the site is

in poor condition, much of the surface that was protected by a bluegrass cover becomes bare.

Loamy Flood Plain, 18- to 30-inch precipitation zone. The potential plant community on this site is dominated by black cottonwood. Other trees in the overstory include Oregon ash, bigleaf maple, white alder, willow, and Oregon white oak. California black oak and ponderosa pine are included in some areas. The understory consists of dense stands of wild grape, blackberry, creambush oceanspray, common snowberry, skunkbush sumac, Pacific serviceberry, mockorange, Klamath plum, and poison oak. Various forbs, such as Spanish clover, mountain sweetroot, curly dock, cinquefoil, nettle, and cowparsnip, grow in a few areas. They are most common beneath openings in the canopy.

Site variation.—Black cottonwood and bigleaf maple are less prominent in areas where the soils are more droughty. Low areas in flood channels are likely to support an understory of grasses and water-tolerant species, such as rushes and sedges.

Associated sites.—The site Deep Loamy Terrace, 18- to 28-inch precipitation zone, is in areas that are not subject to flooding.

Management and response to disturbance.—The more palatable forage plants include oniongrass, sedge, and forbs, such as dandelion and clover. Willow, elderberry, and other shrubs provide some browse. Grazing is limited to the more open areas of this site because of the density of the understory. Excessive grazing pressure results in an increase in the abundance of the less palatable shrubs and herbaceous species, such as Nootka rose, Kentucky bluegrass, sumac, and blackberry.

Areas where the hardwoods have been uprooted by flooding or have deteriorated and have died may become very dense with brush before trees are reestablished. Flood-scoured areas and new deposits of sand and gravel become revegetated with shrubs, such as willow, blackberry, and sumac, or with herbaceous species if there is adequate soil material and some protection from continual scouring is provided.

Loamy Hills, 20- to 35-inch precipitation zone. The potential plant community on this site is dominated by Oregon white oak and varying amounts of California black oak and ponderosa pine. Pacific madrone is included in minor amounts. Shrubs, which are of minor extent, include Pacific serviceberry, Klamath plum, birchleaf mountainmahogany, and hairy honeysuckle. The understory is dominated by Idaho fescue. Other grasses include prairie junegrass, bluebunch wheatgrass, pine bluegrass, California brome, and Lemmon needlegrass. Forbs include western buttercup, wooly eriophyllum, Parry hawkweed, western yarrow, lomatium, and lupine.

Site variation.—California black oak and ponderosa pine are more abundant where this site is in the Cascade Mountains than where it is in the Siskiyou Mountains. Bluebunch wheatgrass becomes prominent in the more droughty or exposed areas. In the Siskiyou Mountains, onsite investigation may be needed to distinguish areas of this site from areas of the Douglas Fir Forest or Pine-Douglas Fir-Fescue site.

Associated sites.—The site Loamy Shrub Scabland, 18- to 35-inch precipitation zone, is in areas where soil depth is limited. The site Clayey Hills, 20- to 35-inch precipitation zone, is in concave areas in the Cascade Mountains. The site Douglas Fir Forest is on north-facing slopes in areas adjacent to timbered sites. The site Pine-Douglas Fir-Fescue is in areas adjacent to timbered sites. The site Droughty North, 18- to 35-inch precipitation zone, is on north-facing slopes. The site Biscuit-Scabland (mound), 18- to 26-inch precipitation zone, is in areas of patterned ground.

Management and response to disturbance.—The more palatable forage plants include Idaho fescue, bluebunch wheatgrass, pine bluegrass, and California brome. Overgrazing results in a decrease in the abundance of the more palatable forage plants and an increase in the abundance of annual forbs and grasses. The prominent grasses that invade include soft brome, ripgut brome, sterile brome, hedgehog dogtail, and medusahead wildrye. The forbs that invade include cleavers bedstraw, tarweed, western snake-root, Klamath weed, and willowweed.

Fire commonly is followed by an initial invasion of wedgeleaf ceanothus, through which whiteleaf manzanita emerges and eventually dominates the site. The result is a dense stand of brush in which nearly all of the understory grasses and forbs are eliminated. In many areas the stand of brush becomes a barrier to livestock movement. The site can be improved if the brush is removed and forage species are seeded.

Loamy Juniper Scabland, 20- to 30-inch precipitation zone. The potential plant community on this site is dominated by scattered western juniper, but an occasional Oregon white oak or ponderosa pine is included in some areas. Shrubs include antelope bitterbrush, shrubby buckwheat, and wedgeleaf ceanothus. Grasses include bluebunch wheatgrass, Sandberg bluegrass, pine bluegrass, Idaho fescue, Thurber needlegrass, and Lemmon needlegrass. Forbs include wooly eriophyllum, hawksbeard, western yarrow, lomatium, and yampa.

Site variation.—Some areas of this site in the eastern part of the survey area support low sagebrush and do not support Oregon white oak or wedgeleaf ceanothus. Areas of this site commonly are adjacent to forested sites. They support an occasional ponderosa pine or other conifer.

Associated sites.—Areas where the soils are deeper include the sites Droughty Slopes, 20- to 30-inch precipitation zone; Loamy Slopes, 18- to 24-inch precipitation zone; Douglas Fir-Mixed Pine-Sedge Forest; and Ponderosa Pine-Fescue.

Management and response to disturbance.—The more palatable forage plants include bluebunch wheatgrass, Idaho fescue, pine bluegrass, Sandberg bluegrass, and antelope bitterbrush. Overgrazing for prolonged periods results in a decrease in the abundance of Idaho fescue and bluebunch wheatgrass and an increase in the abundance of native plants, such as bluegrass, bottlebrush squirreltail, Lemmon needlegrass, and shrubby buckwheat. The plants that invade the site include cheatgrass, annual hairgrass, soft chess, medusahead wildrye, filaree, prickly lettuce, fiddleneck, and knotweed.

Loamy Shrub Scabland, 18- to 35-inch precipitation zone. The potential plant community on this site is dominated by an open stand of wedgeleaf ceanothus. Other shrubs include poison oak and hairy honeysuckle. An occasional Oregon white oak is included in some areas. Grasses include bluebunch wheatgrass, pine bluegrass, Lemmon needlegrass, squirreltail, and Harford's melica. Forbs include coyote mint, wooly eriophyllum, agoseris, and climbing bedstraw.

Site variation.—Areas of this site at an elevation of more than 3,500 feet in the Siskiyou Mountains support birchleaf mountainmahogany mixed with tall Oregon grape, bitter cherry, and Klamath plum. They support little, if any, wedgeleaf ceanothus; Harford's melica is much more prominent. Areas of this site in the western part of the survey area support canyon live oak and Fremont silktassel. Some areas along the Klamath River support antelope bitterbrush and western juniper and do not support poison oak.

Associated sites.—The site Clayey Hills, 20- to 35-inch precipitation zone, is in concave areas in the Cascade Mountains. The site Droughty Slopes, 20- to 30-inch precipitation zone, is in the drainage area of the Klamath River. The site Pine-Douglas Fir-Fescue is in areas adjacent to timbered sites. The site Douglas Fir Forest is on north-facing slopes adjacent to timbered sites. The site Loamy Hills, 20- to 35-inch precipitation zone, is in the drainage area of the Rogue River.

Management and response to disturbance.—The more palatable forage plants include bluebunch wheatgrass, pine bluegrass, Lemmon needlegrass, and Harford's melica. Some areas of this site are the first to be grazed in spring, but the forage can be grazed for only a short period. Overgrazing eventually depletes the perennial grass cover and increases the abundance of annual grasses and forbs.

Loamy Slopes, 18- to 24-inch precipitation zone. The potential plant community on this site is dominated by ponderosa pine. Oregon white oak, California black oak, and Pacific madrone also are common in the overstory. Shrubs include Pacific serviceberry, birchleaf mountainmahogany, Klamath plum, deerbrush, common snowberry, tall Oregon grape, poison oak, and hairy honeysuckle. Grasses include Idaho fescue, California brome, blue wildrye, and pine bluegrass. Forbs, which grow only in small amounts, include wooly eriophyllum, Pacific houndstongue, Parry hawkweed, mountain sweetroot, deltoid balsamroot, climbing bedstraw, and western buttercup.

Site variation.—Poison oak, hairy honeysuckle, Pacific madrone, and whiteleaf manzanita do not grow in the drainage area of the Klamath River.

Associated sites.—The site Douglas Fir-Mixed Pine-Sedge Forest is in the areas in the eastern part of the survey area where the amount of precipitation is greater or the soils are deeper. The site Biscuit-Scabland (intermound), 18- to 26-inch precipitation zone, is in areas of the eastern part of the survey area where soil depth is limited. The site Biscuit-Scabland (mound), 18- to 26-inch precipitation zone, is in some areas. The site Droughty Slopes, 20- to 30-inch precipitation zone, is in areas of range in the eastern part of the survey area. The sites Droughty Fan, 18- to 26-inch precipitation zone, and Droughty Foothill Slopes, 18- to 22-inch precipitation zone, are in areas where the soils are clayey. The site Loamy Hills, 20- to 35-inch precipitation zone, is in some areas.

Management and response to disturbance.—The more palatable forage plants include Idaho fescue, California brome, and pine bluegrass. Overgrazing results in a decrease in the abundance of Idaho fescue and an increase in the abundance of squirreltail, blue wildrye, and other aggressive plants that increase in abundance in areas where they receive partial shade.

Crown fire or overstory removal accompanied by severe surface disturbance stimulates the growth of poison oak and causes the invasion of brush species, such as whiteleaf manzanita and possibly wedgeleaf ceanothus. Oak and Pacific madrone sprout, thus creating brush stands that may persist for years. Ponderosa pine regenerates in some areas after the

burning of the overstory or after logging, and it develops along with the brush. Where logging is not followed by the natural regeneration of pine, the site may remain a brush field for many years.

Mixed Conifer-Bitterbrush-Sedge Forest. The potential plant community on this site is dominated by Douglas fir and white fir, but ponderosa pine, sugar pine, and incense cedar also are important components of the overstory. Understory shrubs include common snowberry, baldhip rose, sierra chinkapin, tall Oregon grape, pachystima, squawcarpet, western princes pine, and scattered antelope bitterbrush in openings that receive more light. The grass cover, which is sparse, includes western fescue, mountain brome, tall trisetum, Ross sedge, and blue wildrye. Forbs include starflower, spreading dogbane, western white anemone, whitevein shinleaf, white hawkweed, and strawberry.

Site variation.—Lodgepole pine grows in areas where restricted air drainage creates cold pockets. Sugar pine and incense cedar do not grow in these areas.

Associated sites.—The site Douglas Fir-Mixed Pine-Sedge Forest, is on south-facing slopes and in areas that are warmer and receive a smaller amount of precipitation. The site Mixed Conifer-Chinkapin-Sedge Forest is in the eastern part of the survey area, south and east of Aspen Lake. The site Wet Loamy Terrace is in areas near Aspen Lake where the water table is higher. The site Ponderosa Pine-Fescue is in areas that are warmer and drier, such as areas at low elevations in basins or bordering meadows. The site Wet Meadow is in basins and near drainageways. The site Loamy Juniper Scabland, 20- to 30-inch precipitation zone, is in areas where soil depth is limited.

Management and response to disturbance.—The more palatable forage plants include western fescue, mountain brome, Orcutt brome, tall trisetum, Ross sedge, Pacific serviceberry, willow, and antelope bitterbrush. The understory includes many aggressive species that increase in abundance where selective logging allows additional light to penetrate the canopy. In the more heavily logged areas, including those that have been clearcut or burned, brush fields can develop and greenleaf manzanita or snowbrush, or both, can invade. Also, the abundance of native shrubs, such as antelope bitterbrush, tall Oregon grape, common snowberry, squawcarpet, and sierra chinkapin, increases considerably. Logging or burning creates open areas that support a greater abundance of shrubs, ponderosa pine, incense cedar, sedge, mountain brome, Orcutt brome, and brackenfern and a few forbs.

Mixed Conifer-Chinkapin-Sedge Forest. The potential plant community on this site is dominated by Douglas fir and white fir, but ponderosa pine, sugar pine, and incense cedar are important components of the overstory. In some areas California black oak also is important. Various trees regenerate. Douglas fir and white fir are the most common regenerated species in highly shaded areas, especially on north-facing slopes. Understory shrubs include common snowberry, baldhip rose, sierra chinkapin, tall Oregon grape, pachystima, squawcarpet, and western princes pine. Grasses, which are sparse, include western fescue, mountain brome, tall trisetum, Ross sedge, and blue wildrye. Forbs include starflower, spreading dogbane, western white anemone, western houndstongue, whitevein shinleaf, white hawkweed, and strawberry.

Site variation.—In areas where restricted air drainage creates cold pockets, such as those in the basin of Johnson Prairie, this site supports lodgepole pine and does not support sugar pine or incense cedar. California black oak, deerbrush, thimbleberry, and a few other species common to the western slope of the Cascade Mountains grow only in the Lincoln area and on the west side of the Parker Mountain-Grizzly Mountain ridge. Whitethorn ceanothus is an important component in areas of this site that are at the northern end of Copco Road. At elevations of more than 5,600 feet on Chase Mountain, this site supports a plant community adapted to drier conditions.

Associated sites.—The site Douglas Fir-Mixed Pine-Sedge Forest is in areas that are warmer and receive a smaller amount of precipitation. The site Mixed Conifer-Bitterbrush-Sedge Forest is in the eastern part of the survey area, south and east of Aspen Lake. The site Mixed Fir-Yew Forest is north of Little Chinkapin Mountain. The site Wet Meadow is in basins and near drainageways. The site Loamy Juniper Scabland, 20- to 30-inch precipitation zone, is in areas where soil depth is limited.

Management and response to disturbance.—The more palatable forage plants include western fescue, mountain brome, Orcutt brome, tall trisetum, Ross sedge, willow, and Pacific serviceberry. The understory includes many aggressive species that increase in abundance where selective logging allows additional light to penetrate the canopy. In the more heavily logged areas, including those that have been clearcut or burned, brush fields can develop and snowbrush or greenleaf manzanita, or both, can invade. Also, the abundance of native shrubs, such as tall Oregon grape, willow, Pacific serviceberry, common snowberry, squawcarpet, and sierra chinkapin, considerably increases. Logging or burning creates open areas that support a greater abundance of shrubs, ponderosa pine, incense cedar, sedge, mountain brome, Orcutt brome, and brackenfern and a few forbs.

Mixed Fir-Dogwood Forest. The potential plant community on this site is dominated by white fir and Douglas fir. Other conifers, which occur in small amounts, include incense cedar, sugar pine, and an occasional Pacific yew. Common hardwoods in the overstory include Pacific madrone, California black oak, golden chinkapin, and an occasional bigleaf maple. The midstory is dominated by Pacific dogwood. Understory shrubs include cascade Oregongrape, Pacific serviceberry, California hazel, creambush oceanspray, common snowberry, and wild rose. Creeping vines, which are common, include yerba buena, American twinflower, Whipplevine, and hairy honeysuckle. Grasses, which are sparse, include western fescue, crinkleawn fescue, mountain brome, Alaska oniongrass, and tall trisetum. Forbs, which are abundant, include deerfoot vanillaleaf, western white anemone, pathfinder, western swordfern, insideout flower, Pacific peavine, spring queen, and Pacific trillium.

Site variation.—Some areas of this site that are at elevations of more than 4,000 feet or that are cold because of restricted air drainage do not support Pacific madrone and California black oak. The north-facing slopes between Little Chinkapin Mountain and the northeastern side of Soda Mountain support a plant community that is adapted to drier conditions. Such species as Pacific madrone, deerfoot vanillaleaf, and Whipplevine do not grow in these areas.

Associated sites.—The site Mixed Fir-Mixed Pine Forest is on south-facing slopes. The sites Semi-Wet Meadow and Wet Meadow are in basins and near drainageways.

Management and response to disturbance.—The more palatable forage plants include western fescue, mountain brome, crinkleawn fescue, Alaska oniongrass, tall trisetum, deerbrush, and creambush oceanspray.

Clearcutting or burning results in the development of dense stands of brush dominated by deerbrush, redstem ceanothus, California hazel, creambush oceanspray, Pacific madrone, and California black oak. Other low shrubs include common snowberry, American twinflower, Whipplevine, baldhip rose, and trailing blackberry. Where there is no Douglas fir or White fir overstory, most of the native grasses and forbs that require much light increase considerably in abundance and ponderosa pine is likely to regenerate.

Hardwoods eventually form a canopy that dominates the brush fields. As the new stand develops, however, the hardwoods and brush fields are suppressed and then are overtopped by conifers. A dense overstory of Douglas fir and white fir normally develops. The dense overstory reduces the abundance of Pacific madrone and oak and the abundance of many understory species. Under these conditions, however, cascade Oregongrape, American twinflower, common snowberry, and numerous light-sensitive species, such as deerfoot vanillaleaf and other forbs, thrive under the shade and thus increase in abundance. Later, as the stand matures or after selective logging, the understory composition can shift to a new balance that favors the more light tolerant species, depending on the amount of light penetrating the canopy.

Mixed Fir-Mixed Pine Forest. The potential plant community on this site is dominated by Douglas fir, but sugar pine and white fir also are common in the overstory. Other coniferous trees include incense cedar and ponderosa pine. Hardwood trees, including California black oak and Pacific madrone, are in the overstory. Pacific dogwood and golden chinkapin are common in the midstory. Understory shrubs include deerbrush, Pacific serviceberry, California hazel, and common snowberry. Tall Oregon grape is the most abundant evergreen shrub, but smaller amounts of cascade Oregongrape, western princes pine, and American twinflower also are evident. Grasses include western fescue, mountain brome, tall trisetum, blue wildrye, California fescue, and Alaska oniongrass. Forbs include starflower, spring queen, pathfinder, iris, and strawberry.

Associated sites.—The site Wet Meadow is in basins and near drainageways. The sites Mixed Fir-Dogwood Forest and Mixed Fir-Western Hemlock Forest are on north-facing slopes. The site Mixed Fir-Serviceberry Forest is in areas that are colder and are at the higher elevations. The site Pine-Douglas Fir-Fescue is in some areas.

Management and response to disturbance.—The more palatable forage plants include western fescue, mountain brome, Alaska oniongrass, tall trisetum, and deerbrush. Because major disturbances in some areas result in the development of dense stands of brush, forage production is low and access by livestock is limited.

Burning or clearcutting initiates sprouting of Pacific madrone and California black oak, which rapidly return to the canopy. Brush fields readily form from a mixture of shrubs, such as Pacific serviceberry, California hazel, deerbrush, common snowberry, and tall Oregon grape. Pacific madrone and California black oak gradually become dominant on the site as they successfully compete with the shrubs.

Ponderosa pine becomes prominent in the early stages of succession, but it thins out as competition for light begins to limit reproduction. Douglas fir and white fir increase in abundance during the later stages of succession, as the density of the overstory increases.

Logging systems other than clearcutting have varied

effects on regeneration, depending upon the species harvested, the amount of timber cut, and the extent of surface disturbance. When the stand is opened up, the dominant species that regenerates is ponderosa pine. Also, the growth rate and degree of crown cover of any suppressed white fir in the stand increase.

Mixed Fir-Mixed Pine Forest, Wet. The potential plant community on this site is dominated by Douglas fir and white fir. Other coniferous plants, which occur in smaller amounts, include ponderosa pine, sugar pine, and incense cedar. Minor amounts of Pacific dogwood and western hemlock are in the midstory or understory. Understory shrubs include common snowberry, Pacific serviceberry, willow, Douglas spirea, American twinflower, cascade Oregongrape, tall Oregon grape, and California hazel. Grasses and grasslike plants include sedge, mannagrass, tall trisetum, mountain brome, western fescue, and blue wildrye. Forbs, which are abundant, include brackenfern, spring queen, strawberry, deerfoot vanillaleaf, fragrant bedstraw, and insideout flower. In the wettest areas, they also include horsetail.

Site variation.—Areas where the water table is nearest the surface or is high for extended periods support a greater abundance of water-tolerant species, such as mannagrass, horsetail, willow, Douglas spirea, and ponderosa pine.

Associated sites.—The site Mixed Fir-Mixed Pine Forest is in areas where the soils do not have a water table. The site Wet Meadow is in basins and near drainageways.

Management and response to disturbance.—The more palatable forage plants include sedge, mannagrass, tall trisetum, mountain brome, western fescue, willow, and Pacific serviceberry. Clearcutting or burning of the overstory results in an increase in the abundance of herbaceous species and the development of stands of brush that include willow, Douglas spirea, Pacific serviceberry, wild rose, California hazel, common snowberry, and tall Oregon grape. Natural regeneration of ponderosa pine, incense cedar, and Douglas fir occurs after a disturbance. The amount of shade provided by the developing canopy and the tolerance of the plants to wetness influence plant succession.

Mixed Fir-Oceanspray Forest. The potential plant community on this site is dominated by white fir. Douglas fir is a codominant species. Many stands are dominated by Douglas fir and are characterized by much regenerated white fir. As these stands mature, the white fir eventually dominates the overstory. Other coniferous trees, which occur in small amounts, include incense cedar and scattered sugar pine, ponderosa pine, California black oak, and bigleaf maple. The midstory is dominated by regenerated trees and tall shrubs, such as creambush oceanspray, Pacific serviceberry, and California hazel. Understory shrubs include cascade Oregongrape, common snowberry, baldhip rose, trailing blackberry, thimbleberry, and American twinflower. The grass cover, which is sparse, includes western fescue, mountain brome, crinkleawn fescue, and Alaska oniongrass. Forbs include starflower, western swordfern, pathfinder, Pacific peavine, western white anemone, whitevein shinleaf, and scouler harebell.

Site variation.—Areas of this site at elevations of less than 4,000 feet support Pacific madrone, California black oak, and scattered poison oak. Areas near King Mountain and Skeleton Mountain in the northwestern part of the survey area support many plants that are the same as those on the Mixed Fir-Salal (rhododendron) Forest site, particularly those that require a greater amount of precipitation.

Associated sites.—The site Mixed Fir-Serviceberry Forest is on south-facing slopes. The sites Wet Meadow and Semi-Wet Meadow are in basins and near drainageways.

Management and response to disturbance.—The more palatable forage plants include mountain brome, western fescue, Alaska oniongrass, crinkleawn fescue, creambush oceanspray, and Pacific serviceberry. Because of the hazard of erosion on the soils that formed in material derived from granitic rock, the more sloping areas should not be grazed.

Clearcutting or burning of the overstory results in the development of dense stands of brush that include creambush oceanspray, Pacific serviceberry, California hazel, common snowberry, baldhip rose, currant, thimbleberry, and gooseberry. In addition to shrubs, ponderosa pine and Douglas fir regenerate mainly during this stage of succession. Grasses and some forbs also become abundant in open areas created by logging or the less severe burns or as a result of the damage caused by insects or disease. Selective logging of Douglas fir allows for the growth of suppressed white fir, which rapidly closes the canopy.

Mixed Fir-Salal (rhododendron) Forest. The potential plant community on this site is dominated by Douglas fir. Other coniferous trees, which occur in small amounts, include white fir, western hemlock, incense cedar, and sugar pine. Hardwoods in the overstory, which are of minor extent, include golden chinkapin, Pacific madrone, and an occasional bigleaf maple. The midstory includes regenerated conifers, Pacific dogwood, and an occasional Pacific yew. Understory

shrubs include salal, Pacific rhododendron, cascade Oregongrape, American twinflower, western princes pine, creambush oceanspray, California hazel, Whipplevine, common snowberry, and red huckleberry. The grass cover, which is sparse, includes western fescue, mountain brome, Alaska oniongrass, and crinkleawn fescue. Small amounts of sedge and common beargrass also are evident. Forbs include deerfoot vanillaleaf, western swordfern, starflower, insideout flower, small false Solomons seal, trillium, calypso, and wild ginger.

Site variation.—Some areas of this site, mainly those on the southern edge of the site's range and where elevation is less than 3,000 feet, do not support rhododendron. Areas at elevations of more than about 4,000 feet support cold-tolerant plants, such as snow bramble, onesided wintergreen, and big huckleberry. Because of a greater amount of precipitation, these areas support a greater abundance of western hemlock.

Associated sites.—The site Douglas Fir-Madrone-Chinkapin Forest is on south-facing slopes. The sites Douglas Fir-Beargrass Forest, Serpentine, and Douglas Fir-Pine Forest, Serpentine, are in areas that are influenced by serpentine.

Management and response to disturbance.—The more palatable forage plants include western fescue, mountain brome, Alaska oniongrass, and creambush oceanspray. The amount of forage is greater in areas that have been recently opened by disturbances, such as logging and fire, and as a result of the damage caused by disease or insects; however, these openings may eventually become dominated by unpalatable evergreen species, such as salal, Pacific rhododendron, manzanita, and golden chinkapin. As a result, brush fields that may be dense enough to restrict access by livestock develop. The normal grazing periods for livestock grazing are in summer or fall. Because of the hazard of erosion on the soils in areas of this site, which formed in material derived from granitic rock or schist, the more sloping areas should not be grazed.

Clearcutting or burning of the overstory results in the development of dense stands of brush that include shrubs, such as salal, Pacific rhododendron, creambush oceanspray, American twinflower, Whipplevine, common snowberry, rose, and trailing blackberry. Other shrubs, such as snowbrush, hoary manzanita, and greenleaf manzanita, invade some areas. Pacific madrone and golden chinkapin sprout rapidly. These species compete well and overtop the shrubs. In small openings created by selective logging or other disturbances in normal stands, the abundance of aggressive shrubs and herbaceous species increases and natural regeneration occurs. In the larger open areas, however, shade-tolerant plants that are sensitive, such as vanillaleaf, Pacific trillium, wild ginger, and Pacific yew, decrease in abundance.

Mixed Fir-Serviceberry Forest. The potential plant community on this site is dominated by Douglas fir and white fir. Other coniferous trees, which occur in small amounts, include ponderosa pine, incense cedar, and an occasional sugar pine. Hardwoods in the overstory, such as Pacific madrone and California black oak, grow sporadically in the Siskiyou Mountains and on the western flank of the Cascade Mountains. The midstory is dominated by regenerated conifers, Pacific serviceberry, and an occasional creambush oceanspray, California hazel, willow, or sierra chinkapin. Understory shrubs include common snowberry, baldhip rose, gooseberry, currant, tall Oregon grape, cascade Oregongrape, western princes pine, and pachystima. The grass cover, which is sparse, includes western fescue, mountain brome, tall trisetum, Alaska oniongrass, sedge, and blue wildrye. The prominent forbs include strawberry, spring queen, starflower, California vetch, mountain sweetroot, western white anemone, small false Solomons seal, and scouler harebell.

Site variation.—Some areas where air drainage is restricted support cold-tolerant species, such as Shasta fir, Pacific yew, and lodgepole pine. These areas are mainly on the Dead Indian Plateau. Some areas at the lower elevations on the western flank of the Cascade Mountains support California fescue and an abundance of California black oak. In slump areas and in areas where the soils are clayey, ponderosa pine is more common and there are fewer species. The species in these areas include cascade Oregongrape, western princes pine, and pachystima.

Associated sites.—The site Mixed Fir-Oceanspray Forest is on north-facing slopes in the Siskiyou Mountains and on west-facing slopes in the Cascade Mountains. The site Mixed Fir-Yew Forest is on north-facing slopes on the Dead Indian Plateau. The site Wet Meadow is in basins and near drainageways.

Management and response to disturbance.—The more palatable forage plants include western fescue, mountain brome, tall trisetum, and Pacific serviceberry.

Clearcutting or burning results in stands of brush that include Pacific serviceberry, creambush oceanspray, willow, common snowberry, baldhip rose, sierra chinkapin, and currant. These stands also include snowbrush and greenleaf manzanita, which invade the site. Where Pacific madrone and California black oak are included, sprouting is extensive in the stands of brush.

Ponderosa pine regenerates most commonly in openings and during stages of succession when there is

full exposure to light. Douglas fir and white fir regenerate later in the succession under partial shade provided by brush and regenerated pine.

Mixed Fir-Western Hemlock Forest. The potential plant community on this site is dominated by white fir and Douglas fir. Other coniferous trees include western hemlock, sugar pine, incense cedar, and Pacific yew. Hardwood trees are limited to golden chinkapin, Pacific dogwood, and Pacific madrone. The prominent tall shrubs are vine maple, California hazel, creambush oceanspray, and Pacific serviceberry. The prominent low deciduous shrubs include thimbleberry, baldhip rose, common snowberry, Whipplevine, and trailing blackberry. Cascade Oregongrape, American twinflower, and western princes pine are the most common evergreen shrubs, but smaller amounts of tall Oregon grape also are evident. The grass cover, which is sparse because of the shade provided by the canopy, commonly includes western fescue, mountain brome, Alaska oniongrass, and crinkleawn fescue. The site supports many forbs, such as deerfoot vanillaleaf, starflower, insideout flower, western swordfern, and pathfinder.

Site variation.—Nearly level areas that are not subject to pooling of cold air support less western hemlock, vine maple, and deerfoot vanillaleaf and more sugar pine, Pacific madrone, and ponderosa pine. In some areas vine maple dominates the understory. Western hemlock dominates the overstory in some areas that are especially moist.

Associated sites.—The site Mixed Fir-Mixed Pine Forest is on south-facing slopes and in areas that receive a smaller amount of precipitation.

Management and response to disturbance.—The more palatable forage plants include western fescue, mountain brome, Alaska oniongrass, several forbs, and shrubs, such as Pacific serviceberry and creambush oceanspray.

Clearcutting or burning generally results in the development of dense brush fields that include vine maple, dewberry, chinkapin, California hazel, common snowberry, and creambush oceanspray. Redstem ceanothus, deerbrush, snowbrush, and greenleaf manzanita invade the site. Because of cold temperatures in some areas, conifers may be slow to regain dominance of the site. Coniferous trees that emerge through the brush commonly have a better growth form and a better survival rate than those that are more exposed to the cold. In the absence of a brush cover, some grasses and sedge become very competitive and thus threaten the survival of tree seedlings.

The response of plants to logging or burning varies, depending on the species involved, the degree of cutting or burning, and the extent of surface disturbance. Mountain brome, brackenfern, trailing blackberry, and strawberry become more abundant in open areas, where there is less competition for light and moisture.

Mixed Fir-Yew Forest. The potential plant community on this site is dominated by white fir. Douglas fir is a codominant species. Minor amounts of western white pine and Shasta red fir are included in some stands. The midstory is dominated by an abundance of regenerated Pacific yew, sierra chinkapin, and conifers. Understory shrubs include cascade Oregongrape, common snowberry, western princes pine, big huckleberry, pachystima, gooseberry, American twinflower, and baldhip rose. Grasses, which are of minor extent, include western fescue, mountain brome, Alaska oniongrass, and tall trisetum. Forbs, which are abundant, include insideout flower, starflower, western white anemone, wild ginger, onesided wintergreen, beadlily, and pathfinder.

Site variation.—Areas of this site south of Oregon State Highway 66 and on Grizzly Mountain, along the Jackson-Klamath County line, show the effects of less precipitation and warmer temperatures. These areas support hardwoods, such as California black oak and Pacific dogwood, and have a smaller amount of Pacific yew. Some low areas on the Dead Indian Plateau where air drainage is restricted support stands of lodgepole pine.

Associated sites.—The site Wet Meadow is in basins and near drainageways. The site Mixed Fir-Serviceberry Forest is on south-facing slopes. The site Mixed Fir-Oceanspray is on the western slopes of the Cascade Mountains. The site Mixed Conifer-Chinkapin-Sedge Forest is in the upper part of the basin of Jenny Creek.

Management and response to disturbance.—The more palatable forage plants include mountain brome, western fescue, Alaska oniongrass, tall trisetum, and shrubs, such as Pacific serviceberry.

Regenerating clearcut or burned areas that are not replanted is difficult. Pacific yew slowly dies out when most of the protective conifer overstory is removed. Removal of the overstory or burning, or both, commonly is followed either by the growth of a cover of grasses and sedge or by the development of brush fields. The stands of brush include gooseberry, blue elderberry, Pacific serviceberry, mountain ash, and common snowberry and invaders, such as snowbrush and greenleaf manzanita. Stands of grasses and sedge commonly provide habitat for large populations of rodents, especially gophers, which damage a large number of seedlings. Selective logging and thinning

result in the rapid growth of suppressed white fir, Douglas fir, and incense cedar. These practices allow natural regeneration. Also, underplanting is somewhat successful where these practices have been applied.

Mixed Pine-Douglas Fir-Fescue Forest, Granitic. The potential plant community on this site is dominated by ponderosa pine and Douglas fir. Sugar pine, although important, is less common on the site, and incense cedar grows only sporadically. Common hardwood trees in the overstory include Pacific madrone and California black oak. Understory shrubs include deerbrush, Brewers lupine, poison oak, common snowberry, tall Oregon grape, whiteleaf manzanita, and hairy honeysuckle. Grasses include Idaho fescue, western fescue, blue wildrye, mountain brome, prairie junegrass, tall trisetum, and California fescue. Forbs, which are of minor extent, include white hawkweed, lupine, tarweed, iris, brackenfern, mountain sweetroot, and California bellflower.

Associated sites.—The site Douglas Fir-Mixed Pine-Fescue Forest is in areas of deep soils that formed in material derived from granitic rock and have slopes of less than about 20 percent. The site Douglas Fir Forest is on north-facing slopes. The site Pine-Douglas Fir-Fescue is on the less sloping soils that are on south-facing slopes and are not influenced by granitic rock.

Management and response to disturbance.—The more palatable forage plants include Idaho fescue, western fescue, tall trisetum, prairie junegrass, and deerbrush. Because major disturbances result in the development of dense stands of brush, forage production is low in some areas and access by livestock is limited. Logging or burning results in the development of dense stands of brush dominated by whiteleaf manzanita and deerbrush. Poison oak and sprouted Pacific madrone and California black oak also are abundant. Clearcutting or heavy partial cutting that removes many of the overstory plants can result in slow regeneration of timber species. Very light partial cutting is less detrimental to the site and should promote the regeneration of conifers.

Noble Fir-Bush Chinkapin Forest. The potential plant community on this site is dominated by noble fir and white fir. Other coniferous trees, which occur in small amounts, include Douglas fir and incense cedar. Understory shrubs include sierra chinkapin, pinemat manzanita, currant, western princes pine, dwarf bramble, and big huckleberry. Grasses and grasslike plants include sedge, mountain brome, and western fescue. Forbs include onesided wintergreen, small false Solomons seal, beadlily, whitevein shinleaf, western white anemone, and common beargrass.

Associated sites.—The site Douglas Fir-Beargrass Forest, Serpentine, is in areas that are influenced by serpentinite. The site Mixed Fir-Oceanspray Forest is on north-facing slopes at the lower elevations. The site Mixed Fir-Serviceberry Forest is on south-facing slopes at the lower elevations.

Management and response to disturbance.—The more palatable forage plants include sedge, mountain brome, and western fescue. Disturbances, such as clearcutting and burning of the overstory, result in the development of dense stands of brush that include invaders, such as greenleaf manzanita and snowbrush, and native shrubs, such as pinemat manzanita and sierra chinkapin. Herbaceous species, such as sedge, white hawkweed, and common beargrass, increase in abundance in the disturbed areas.

Pine-Douglas Fir-Fescue. The potential plant community on this site is dominated by ponderosa pine and Douglas fir. Hardwood trees include California black oak and Pacific madrone. Other trees, which occur in minor amounts, include incense cedar, Oregon white oak, and canyon live oak. Understory shrubs include Pacific serviceberry, tall Oregon grape, common snowberry, deerbrush, birchleaf mountainmahogany, and poison oak. Grasses are abundant, particularly in areas where the canopy is open. California fescue and Idaho fescue are the dominant grasses. Other grasses include California brome, mountain brome, tall trisetum, prairie junegrass, and western fescue. Forbs include wooly eriophyllum, iris, strawberry, hawkweed, and mountain sweetroot.

Site variation.—In the older stands on this site, Douglas fir commonly is more abundant than ponderosa pine. Canyon live oak generally does not grow in the areas of this site in the Cascade Mountains. Areas at elevations of more than 4,000 feet generally support small amounts of white fir, more Douglas fir, and less Pacific madrone and poison oak. In some areas Oregon white oak and California black oak are dominant. In the Siskiyou Mountains, onsite investigation may be needed to distinguish areas of this site from areas of the sites Loamy Hills, 20- to 35-inch precipitation zone, and Droughty North, 18- to 35-inch precipitation zone.

Associated sites.—The site Douglas Fir Forest is on north-facing slopes. The site Douglas Fir-Mixed Pine-Fescue Forest is in some areas.

Management and response to disturbance.—The more palatable forage plants include Idaho fescue, Harford's melica, tall trisetum, western fescue, and deerbrush. Because major disturbances can result in the development of dense stands of brush, forage production is low in some areas and access by livestock is limited.

Figure 15.—The vegetative site Ponderosa Pine-Fescue in an area of Bly-Royst complex, 12 to 35 percent slopes. The shrubs in the understory are antelope bitterbrush.

Severe burning or clearcutting of the overstory can result in the development of dense stands of deerbrush, poison oak, whiteleaf manzanita, and hardwoods. Pacific madrone, California black oak, and small amounts of Oregon white oak gradually become dominant on the site as they outgrow the shrubs. Regeneration of ponderosa pine is evident in the openings; however, Douglas fir is slow to return and commonly grows only in the protective shade of the hardwood canopy. Selective logging of conifers commonly results in an increase in the abundance of the hardwood overstory and shrubs, particularly in areas where the surface has been disturbed.

Ponderosa Pine-Fescue. The potential plant community on this site is dominated by ponderosa pine (fig. 15). The site has no other trees, except for very small amounts of white fir, incense cedar, Douglas fir, and western juniper. The midstory includes regenerated curlleaf or birchleaf mountainmahogany and ponderosa

pine. Understory shrubs include antelope bitterbrush, common snowberry, squawcarpet, Pacific serviceberry, greenleaf manzanita, and Klamath plum. Grasses and grasslike plants include sedge, Idaho fescue, western fescue, mountain brome, western needlegrass, and wheeler bluegrass. Forbs include wooly wyethia, white hawkweed, groundsel, American vetch, and strawberry.

Associated sites.—The sites Douglas Fir-Mixed Pine-Sedge Forest and Mixed Conifer-Bitterbrush-Sedge Forest are in some areas. The site Deep Loamy, 16- to 20-inch precipitation zone, is in areas that receive a smaller amount of precipitation. The sites Loamy Juniper Scabland, 20- to 30-inch precipitation zone, and Droughty Slopes, 20- to 30-inch precipitation zone, are in areas where soil depth is limited. The site Wet Meadow is in basins and near drainageways.

Management and response to disturbance.—The more palatable forage plants include Idaho fescue, sedge, Wheeler bluegrass, mountain brome, and western fescue. If the site is grazed in the fall, they also include antelope bitterbrush. Overgrazing for prolonged periods results in a decrease in the abundance of the preferred forage plants and possible damage to tree reproduction. It also can result in minor increases in the abundance of bottlebrush squirreltail, needlegrass, and pine bluegrass, although changes in plant composition are more significantly influenced by surface disturbance, canopy removal, and competition among species for moisture and light.

Ground fires tend to increase the potential for perennial bunchgrasses, temporarily reduce the abundance of bitterbrush, and reduce the density of young ponderosa pine. Logging and burning can result in increases in the abundance of greenleaf manzanita and squawcarpet. Minor invasions or increases in the abundance of big sagebrush, green rabbitbrush, western juniper, cheatgrass, and thistle also are likely. Dense stands of stagnated regenerated ponderosa pine develop in some areas following disturbances. In such stands the abundance of grasses and antelope bitterbrush is reduced.

Poorly Drained Bottom. The potential plant community on this site includes rushes, sedges, mannagrass, cattails, willows, and timothy. Scattered California white oak or Oregon ash and clumps of willows make up the overstory in some areas.

Associated sites.—Areas where the soils are better drained include the sites Droughty Fan, 18- to 26-inch precipitation zone; Deep Loamy Terrace, 18- to 28-inch precipitation zone; Loamy Hills, 20- to 35-inch precipitation zone; and Semi-Wet Meadow. The site Biscuit-Scabland (mound), 18- to 26-inch precipitation zone, is in areas of patterned ground where the soils are well drained.

Management and response to disturbance.—The more palatable forage plants include sedges and grasses, such as timothy and mannagrass. In many areas this site is too wet to be used for livestock grazing. Overgrazing results in a decrease in the abundance of the more palatable plants and an increase in the abundance of the less palatable herbaceous species. In a few areas, it also results in an increase in the abundance of blackberry.

Semi-Wet Meadow.—The potential native plant community on this site is dominated by California oatgrass. The site supports sedge and minor amounts of Canada bluegrass, Kentucky bluegrass, timothy, slender wheatgrass, and other grasses. Forbs, which are abundant, include swamp buttercup, clover, cinquefoil, Douglas aster, and brodiaea. Trees and shrubs are not common on this site; however, willow, birch, and spirea grow in some areas.

Site variation.—Numerous areas of this site support an occasional ponderosa pine, and some support a full overstory of ponderosa pine.

Associated sites.—The site Droughty Fan, 18- to 26-inch precipitation zone, is in areas of the better drained soils. The site Poorly Drained Bottom is in areas of the more poorly drained soils. The sites Clayey Hills, 20- to 35-inch precipitation zone, and Loamy Hills, 20- to 35-inch precipitation zone, are in some areas.

Management and response to disturbance.—The more palatable forage plants include California oatgrass, timothy, slender wheatgrass, redtop, and Kentucky bluegrass. Overgrazing for prolonged periods results in a decrease in the abundance of California oatgrass and an increase in the abundance of bluegrass and sedge. If overgrazing continues, most of the oatgrass is removed and the stand is dominated by bluegrass, sedge, annual grasses, and numerous forbs, such as plantain, owlclover, western yarrow, brodiaea, aster, and cinquefoil. Although renovating is difficult, the site can produce high forage yields if it is seeded to suitable species.

Shallow Mountain Slopes, 22- to 30-inch precipitation zone. The potential plant community on this site is dominated by Idaho fescue. Pine bluegrass, prairie junegrass, and bluebunch wheatgrass also are prominent. Forbs include wooly eriophyllum, lomatium, agoseris, Brewer lupine, hawkweed, brown peony, and balsamroot. Shrubs, which are sparse, include northern buckwheat, Klamath plum, tall Oregon grape, bitter cherry, and birchleaf mountainmahogany. The site

supports minor amounts of western juniper, ponderosa pine, and Oregon white oak.

Site variation.—Western juniper grows in the areas of this site in the eastern part of the survey area. Oregon white oak generally grows at the low or intermediate elevations. Birchleaf mountainmahogany and bitter cherry commonly grow on the margins of the site, mainly at the higher elevations.

Associated sites.—The site Loamy Shrub Scabland, 18- to 35-inch precipitation zone, is in areas where the soils are less sloping. The sites Pine-Douglas Fir-Fescue and Douglas Fir Forest are in areas adjacent to forested sites. The site Droughty North, 18- to 35-inch precipitation zone, is on north-facing slopes. The site Loamy Hills, 20- to 35-inch precipitation zone, is in some areas.

Management and response to disturbance.—The more palatable forage plants include Idaho fescue, bluebunch wheatgrass, and pine bluegrass. Overgrazing eventually reduces the abundance of Idaho fescue and bluebunch wheatgrass. Lemmon needlegrass, which replaces these perennial grasses, effectively protects the soils but is less palatable as forage. If overgrazing continues, the site is converted to gray rabbitbrush, annual grasses, and annual forbs, such as medusahead wildrye, cheatgrass, soft chess, hedgehog dogtail, Klamath weed, knotweed, and filaree.

The effects of burning vary on this site. Wildfire may temporarily injure fire-sensitive Idaho fescue while stimulating the growth of bluebunch wheatgrass and gray rabbitbrush, depending on the nature of the fire. Burns that are not too severe invigorate the cover of perennial bunchgrasses.

Shallow Serpentine, 30- to 40-inch precipitation zone. The potential plant community on this site is dominated by an open stand of Jeffrey pine. Some Douglas fir, incense cedar, and Pacific madrone grow in places, especially in the understory. Shrubs, which are of minor extent, include shrubby buckwheat, wedgeleaf ceanothus, and whiteleaf manzanita in some areas. The understory is dominated by grasses and forbs. Sheep fescue is the main grass, but the site supports minor amounts of Lemmon needlegrass, California fescue, pine bluegrass, California brome, and bottlebrush squirreltail. Forbs include wooly eriophyllum, lomatium, field buttercup, Indian dream fern, deathcamas, and western yarrow.

Site variation.—Areas where the soils are deeper or receive a greater amount of precipitation support more Pacific madrone, Douglas fir, and California fescue.

Associated sites.—The sites Douglas Fir-Chinkapin Forest, Douglas Fir-Black Oak Forest, Mixed Fir-Salal (rhododendron) Forest, and Douglas Fir-Madrone-Chinkapin Forest are adjacent to this site. They are less influenced by serpentinite. The sites Douglas Fir-Beargrass Forest, Serpentine, and Douglas Fir-Pine Forest, Serpentine, are in areas of the deeper soils that formed in material derived from serpentine.

Management and response to disturbance.—The more palatable forage plants include sheep fescue and pine bluegrass. California brome, bottlebrush squirreltail, and Lemmon needlegrass are important forage plants in areas where the site is in poor condition. A decrease in the abundance of sheep fescue permits an increase in the abundance of such species as bottlebrush squirreltail, Lemmon needlegrass, pine bluegrass, deathcamas, field buttercup, and hawkweed. Fire is followed by sporadic regeneration of Jeffrey pine, knobcone pine, and incense cedar in some areas. Whiteleaf manzanita and wedgeleaf ceanothus can become prominent after a fire.

Shasta Fir-White Pine-Princes Pine Forest. The potential plant community on this site is dominated by Shasta red fir and white fir. Western white pine also is common. Douglas fir and ponderosa pine occur only in small amounts. The midstory includes mainly regenerated conifers. Understory shrubs, which are abundant, include western princes pine, sierra chinkapin, gooseberry, pachystima, big huckleberry, dwarf bramble, common snowberry, and wild rose. Grasses and grasslike plants include sedge, mountain brome, Alaska oniongrass, tall trisetum, and western fescue. Forbs include scouler harebell, western white anemone, onesided wintergreen, wild ginger, fragrant bedstraw, and whitevein shinleaf.

Associated sites.—The sites White Fir-White Pine Forest and Wet Meadow are in basins and near drainageways. The site White Fir-Shasta Fir Forest is on south-facing slopes.

Management and response to disturbance.—The more palatable forage plants include sedge, mountain brome, tall trisetum, Alaska oniongrass, and western fescue. Forage production in typical middle-aged or old-growth stands is low in all areas, except for well lighted openings. Access by livestock is limited in some areas where major disturbances result in the development of dense stands of brush.

Clearcutting or burning of the overstory results in the development of dense stands of brush that include sierra chinkapin and invading shrubs, such as greenleaf manzanita and snowbrush. Sedge and grasses significantly increase in abundance and then interfere with the regeneration of trees. White fir and Shasta red fir may be slow to reoccupy the site after the overstory is removed. These species depend on the shade and

protection from frost that are provided by stands of brush and the more aggressive lodgepole pine that invades some disturbed areas. Partial cutting and the less severe burns promote regeneration and the growth of new seedlings of white fir, Shasta red fir, and possibly Douglas fir.

Wet Loamy Terrace. The potential plant community on this site is dominated by ponderosa pine. Small amounts of lodgepole pine, incense cedar, white fir, and Douglas fir are in some areas. Stands of shrubs are dominated by Douglas spirea, but they also include common snowberry, Pacific serviceberry, willow, squawcarpet, tall Oregon grape, and trailing blackberry. Grasses include Idaho fescue, western fescue, prairie junegrass, and Orcutt brome. Forbs include wooly eriophyllum, mountain sweetroot, western yarrow, sticky cinquefoil, and strawberry.

Site variation.—The wetter areas of this site support a greater abundance of lodgepole pine and water-tolerant species. Areas of the better drained soils support more Douglas fir, white fir, and incense cedar and less Douglas spirea.

Associated sites.—The site Wet Meadow is in basins and near drainageways. The sites Ponderosa Pine-Fescue and Mixed Conifer-Bitterbrush-Sedge Forest are in some areas.

Management and response to disturbance.—The more palatable forage plants include Idaho fescue, western fescue, and Orcutt brome. Removal of the overstory or burning is likely to initiate regeneration of ponderosa pine and increase the abundance of such plants as tall Oregon grape, trailing blackberry, Pacific serviceberry, willow, and common snowberry.

Wet Meadow. The potential plant community on this site is dominated by tufted hairgrass. Sedge and meadow barley are important secondary species. Small amounts of mat muhly also are on the site. The most common forb is swamp buttercup. Other prominent forbs include cinquefoil, Douglas aster, and bigleaf lupine. Trees and shrubs are not characteristic on this site, but quaking aspen, birch, spirea, or willow grows in some areas.

Site variation.—Some areas adjacent to forested sites support an overstory of ponderosa pine. The proportion of tufted hairgrass and sedge varies, depending on the degree of wetness on the site. Some very wet areas are dominated by sedge. Lodgepole pine grows in some cold areas in the Cascade Mountains.

Management and response to disturbance.—The more palatable forage plants include tufted hairgrass and meadow barley. Overgrazing for prolonged periods results in a decrease in the abundance of tufted hairgrass and an increase in the abundance of the less palatable species, such as sedge. If overgrazing continues, tufted hairgrass is removed from the stand, which then becomes dominated by sedge, meadow barley, redtop, and native forbs, such as swamp buttercup, clover, false hellebore, and cinquefoil. Invaders, such as Kentucky bluegrass, redtop, rush, and velvetgrass, are in some overgrazed areas.

White Fir Forest.—The potential native plant community on this site is dominated by white fir and has only traces of other conifers, Douglas fir, and incense cedar. The midstory is limited to scattered white fir and minor amounts of Rocky Mountain maple, Pacific serviceberry, and gooseberry. The understory, which is sparse, includes shrubs, such as common snowberry, western princes pine, little princes pine, cascade Oregongrape, and baldhip rose. Grasses include Canada bluegrass, Alaska oniongrass, western fescue, and mountain brome. Sedge also grows on the site. Forbs include mountain sweetroot, scouler harebell, western white anemone, western baneberry, sandwort, candyflower, starflower, fragrant bedstraw, small false Solomons seal, insideout flower, and trillium.

Site variation.—In the northern part of the survey area, areas of this site where the amount of precipitation is greater support more cascade Oregongrape or support such plants as thimbleberry, brackenfern, wild ginger, and deerfoot vanillaleaf. At elevations of more than 5,600 feet on Chase Mountain, areas of this site support a plant community that is adapted to drier conditions. Sierra chinkapin is the most prominent understory species in these areas.

Associated sites.—The site Mixed Fir-Serviceberry Forest is on south-facing slopes.

Management and response to disturbance.—The production of palatable forage on this site is low, even in areas that have been opened. Livestock graze such species as Canada bluegrass, Alaska oniongrass, mountain broom, sedge, and blue elderberry. Regeneration is extremely difficult in areas that have been clearcut or burned. These disturbed areas have remained open for long periods, and there has been some increase in the abundance of forbs and gooseberry. Blue elderberry has invaded these areas.

White Fir-Shasta Fir Forest. The potential plant community on this site is dominated by white fir and Shasta red fir. Other conifers, which occur in small amounts, include ponderosa pine, western white pine, and Douglas fir. Understory plants, which are sparse, include shrubs, such as gooseberry, sierra chinkapin, common snowberry, western princes pine, and pachystima. The main grasses and grasslike plants are

sedge and mountain brome, but the site supports some Alaska oniongrass and western fescue. Forbs include onesided wintergreen, scouler harebell, whitevein shinleaf, wild ginger, and small false Solomons seal.

Associated sites.—The site Shasta Fir-White Pine-Princes Pine Forest is on north-facing slopes. The site White Fir-White Pine Forest is in cold-air drainage basins. The site Wet Meadow is in basins and near drainageways.

Management and response to disturbance.—The more palatable forage plants include sedge, mountain brome, Alaska oniongrass, and western fescue. Forage production in typical middle-aged or old-growth stands is low in all areas, except for well lighted openings and recently logged areas.

Clearcutting or burning of the overstory results in the development of dense stands of brush that include invading shrubs, such as greenleaf manzanita and snowbrush, and native shrubs, such as sierra chinkapin, gooseberry, and common snowberry. Sedge and grasses increase significantly in abundance and can interfere with the regeneration of trees. White fir and Shasta red fir may be slow to reoccupy the site after the overstory has been removed. These species depend on the shade and frost protection provided by stands of brush and the more aggressive conifers, such as ponderosa pine and Douglas fir.

Partial cutting and the less severe burns promote regeneration and the growth of new seedlings of white fir and Shasta red fir. In some areas heavy partial cutting promotes regeneration of Douglas fir and ponderosa pine.

White Fir-White Pine Forest. The potential plant community on this site is dominated by white fir. Western white pine and ponderosa pine commonly are included in the overstory. Small amounts of Douglas fir also are included. The midstory includes scattered white fir, western white pine, and lodgepole pine. Understory shrubs include gooseberry, western princes pine, squawcarpet, pachystima, and wild rose. Grasses and grasslike plants include an abundance of sedge. They also include mountain brome, western fescue, tall trisetum, and blue wildrye. Forbs include scouler harebell, onesided wintergreen, whitevein shinleaf, western white anemone, small false Solomons seal, and fragrant bedstraw.

Associated sites.—The site Wet Meadow is near drainageways. The site Shasta Fir-White Pine-Princes Pine Forest is in nearly level areas and on north-facing slopes. The site White Fir-Shasta Fir Forest is on south-facing slopes.

Management and response to disturbance.—The more palatable forage plants include sedge, mountain brome, tall trisetum, and western fescue. In heavily logged areas that are burned, there is a significant increase in the abundance of sedge, some shrubs, and lodgepole pine. In some areas lodgepole pine is codominant in the stand during periods when white fir is becoming reestablished. Ponderosa pine is most likely to regenerate following partial cutting, when it is under a lodgepole pine canopy, or following the less severe burns. Since ponderosa pine is more sensitive to frost than lodgepole pine, it does not readily become established in large clearings that are not protected from cold temperatures.

Woodland Management and Productivity

Gary Kuhn, forester, Soil Conservation Service, helped prepare this section.

This survey area is one of the most productive timber-growing regions of North America. Favorable climate, fertile soils, and well adapted timber species account for the high productivity. The most productive timber sites are those at intermediate elevations, and the least productive ones are those at the higher elevations.

About 64 percent of the survey area is classified as commercial forest land. About 42 percent of this land is privately owned, and the rest is publicly owned. Most of the publicly owned forest land is managed by the Federal Government. The rest is managed by the state and the counties. The Forest Service, the Oregon State Department of Forestry, and local fire districts provide fire protection.

Jackson County produces 8 percent of the lumber produced annually in the western part of Oregon. In 1986, it produced a total of about 525 million board feet. Of this total, 39 percent was produced from pine, mainly ponderosa pine and sugar pine; 33 percent from Douglas fir; 27 percent from white fir; and 2 percent from incense cedar. Forest industry land provided 46 percent of the harvest; national forests, 35 percent; land administered by the Bureau of Land Management, 18 percent; nonindustrial private land, 1 percent; and state land, 0.2 percent *(15)*. The lumber mills in Jackson County have the daily capacity to produce 3.5 to 4.0 million board feet of lumber and 5.5 to 6.0 million square feet of plywood.

A substantial amount of firewood for wood stoves is produced from slash, as a by-product of thinning, and from woodland dominated by hardwoods. All species are used for firewood. Pacific madrone and Douglas fir are the most valuable ones for this use.

Some small ponderosa pine logs are used for the construction of log homes. Other products include laminated beams, particle board, hardwood plywood,

and wood chips for export and for domestic use.

Soils vary in their ability to produce trees. Their depth, fertility, texture, and available water capacity influence tree growth. Elevation, aspect, the kinds of soil, and climate determine the kinds of trees that can be expected to grow on any given site. Available water capacity and the thickness of the root zone are of major importance. Elevation and aspect, or the direction that a slope faces, are of particular importance in mountainous areas. The forested soils in the survey area range from shallow to very deep, from nongravelly to extremely gravelly, and from fine textured to coarse textured. Because of the differences among the soils, as well as differences in climate, topography, and geology, the forests vary in composition and productivity.

Soil surveys are important to woodland managers seeking ways to increase the productivity of woodland. Some soils respond better to applications of fertilizer than others, some are more susceptible to landslides and erosion after roads are built and timber is harvested, and some require special harvesting and reforestation efforts.

Table 7 summarizes the forestry information given in the detailed soil map unit descriptions and provides a means of quickly finding woodland interpretations. Map unit symbols are listed in the table, and the site index for each unit is given. The major management concerns also are given.

In table 7, the soils are rated for a number of factors to be considered in woodland management. *Slight*, *moderate*, and *severe* indicate the degree of the major soil limitation. For each moderate or severe rating, a sentence in the applicable detailed soil map unit addresses that rating.

Ratings of *equipment limitation* reflect soil characteristics that limit the use of equipment. A rating of *slight* indicates that equipment use is not normally restricted because of soil factors; *moderate* indicates that there is a short seasonal limitation because of soil wetness, a fluctuating water table, or some other factor; and *severe* indicates that there is a seasonal limitation, a need for special equipment, or a hazard affecting the use of equipment.

Slope, wetness, and the susceptibility of the soil to compaction are the main factors that cause an equipment limitation. As the gradient and length of slopes increase, operating wheeled equipment becomes more difficult. On the steeper slopes, tracked equipment must be used. On the steepest slopes, cable yarding systems may be needed. Wetness, especially in areas where the soil is fine textured, can severely limit the use of equipment and make harvesting practical only during the dry period in summer. Compaction is always a concern where silvicultural activities are performed.

Ratings of *seedling mortality* indicate the degree to which soil or topographic conditions affect the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to healthy, dormant seedlings from good stock that are properly planted during a period when sufficient moisture is received. *Slight* indicates that no problem is expected under normal conditions; *moderate* indicates that some problems of mortality can be expected and that extra precautions are advisable; and *severe* indicates that mortality will be high and that extra precautions are essential for successful reforestation.

Wetness, droughtiness, and topographic conditions account for seedling mortality problems. To offset these concerns, larger than usual planting stock, special site preparation, a surface drainage system, or reinforcement planting may be needed.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees are not normally blown down during wet periods when winds are moderate or strong; *moderate* indicates that an occasional tree may be blown down during these periods; and *severe* indicates that many trees may be blown down during these periods.

A restricted rooting depth in a soil that has a high water table, bedrock, or an impervious layer and poor anchoring of roots in a loose soil are responsible for windthrow. Moderate and severe ratings indicate the need for care in thinning forest stands, the periodic removal of windblown trees, and an adequate road and trail system that allows for the removal of those trees.

Ratings of *plant competition* refer to the likelihood of the invasion of undesirable plants when openings are made in the tree canopy. A rating of *slight* indicates that unwanted plants are not likely to delay the development of natural or planted seedlings; *moderate* indicates that competition will delay reforestation; and *severe* indicates that competition can be expected to prevent reforestation.

Favorable climate and soil characteristics result in plant competition. Generally, the key to predicting plant competition problems is the quantity of and proximity to seed sources of undesirable plants or the quantity of unwanted brush rootstock that will resprout after harvesting. Moderate and severe ratings indicate the need for careful and thorough site preparation and the potential need for mechanical or chemical treatment to delay the growth of competing vegetation.

The *potential productivity* of *common trees* on a soil is expressed as a site index and a productivity class. The *site index* is determined by measuring the height and age of selected trees in stands of a given species. The

procedure for calculating the site index is described in publications cited at the back of this survey for the following species: Douglas fir *(3, 7, 9)*; ponderosa pine and Jeffrey pine *(11)*; Shasta red fir *(19)*; and white fir *(20)*. The site index applies to fully stocked, even-aged stands of trees growing on a particular detailed soil map unit. The highest timber yields can be expected on those map units that have the highest site indexes. Site index values can be converted into estimated yields at various ages by carefully using the appropriate yield tables.

The *productivity class* is based on a uniform system used to indicate the potential productivity of an individual soil. The productivity class is a number that denotes the potential productivity in terms of cubic meters of wood per hectare per year for the indicator tree species (the species that is listed first in the detailed soil map units and in table 7 for a particular map unit). Potential productivity is based on the site index and the corresponding culmination of mean annual increment. For example, the number 1 indicates a potential production of 1 cubic meter of wood per hectare per year (14.3 cubic feet per acre per year) and 10 indicates a potential production of 10 cubic meters of wood per hectare per year (143 cubic feet per acre per year).

Trees to plant are those that are suited to the soils and to commercial wood production.

This survey area is characterized by a wide variety of geologic, climatic, and topographic conditions and thus a variety of vegetative sites. The main kind of site is one on which Douglas fir is the primary tree species, but the sites in the area range from those on which Oregon white oak is the sole tree species to mixed stands of Shasta fir, white fir, and western white pine. A more detailed description of vegetative sites is given under the heading "Vegetative Zones and Sites." Because of the variety of vegetative sites in the survey area, forest management is complex and includes many factors.

The major concern in managing the forested areas in the survey area is reforestation, which is influenced by plant competition, site preparation, seedling mortality, erosion, and compaction. Plant competition depends on the nature of the native plants on a given site or on adjacent sites and the ability of the plants to increase in abundance or to invade after a stand has been opened. These plants commonly are hardwood trees, shrubs, grasses, and forbs, depending on the characteristics of the soil and the nature of the geographic area. Invaders compete with the desirable tree species primarily for moisture but also for sunlight and nutrients.

Site preparation involves reducing the amount of logging debris and understory vegetation on the site so that natural reforestation can take place. The methods that can be used to prepare a site include prescribed burning, mulching, mechanical treatment, and chemical treatment. The actual methods used depend on such factors as the slope, the kind of soil, and federal and state regulations.

Prescribed burning reduces the quantity of logging debris, exposes mineral soil material suitable for natural seeding, and reduces the amount of competing vegetation. Severe burns, however, can reduce productivity by destroying the duff layer, can reduce the amount of nitrogen in the soil, and can increase the hazard of erosion. The severity of prescribed burns should be kept low. Burning in winter and spring, when the moisture content of the fuel usually is high, reduces the intensity of burns.

Mulch consisting of such material as paper and polyester fiber can be placed around the base of seedlings to control competition from other vegetation and minimize the loss of soil moisture through transpiration and evaporation.

Mechanical treatment can consist of such practices as the manual cutting of brush, the use of hand tools to scalp the vegetation around seedlings, or land treatment involving the use of heavy equipment. Manual cutting removes brush and sprouted hardwoods from the more sloping soils. Heavy equipment commonly is used to distribute logging debris and brush over areas of gently sloping soils.

Chemical treatment is effective in controlling the invasion of brush and the sprouting of hardwoods, particularly in areas where the use of ground equipment is limited.

Seedling mortality results from several site factors, including climate, aspect, topography, and kind of soil. Other factors to be considered are the damage caused by animals, the quality of the planting stock, and the species to be planted. Seedling mortality generally is more severe on sites that are hot and dry, particularly from late in spring through summer, and on sites that are cold. On hot, dry sites, seedling mortality commonly results from moisture stress and from tissue damage near the soil-stem boundary. In cold areas frost in summer kills exposed seedlings, particularly those of Douglas fir and true firs. Ponderosa pine is less susceptible to summer frost. If the seedlings are not killed, terminal bud damage results in poor growth form and may reduce productivity until the crown of the tree reaches a height above the layer of cold air.

Such timber management practices as clearcutting may influence the seedling mortality rate in cold areas. Depending on the size of the clearcut area and its topographic position, an artificial pocket of cold air can be created. The cold air can increase the seedling

mortality rate. Management practices that leave a certain number of overstory trees on the site reduce the potential for seedling mortality because the trees tend to disrupt the flow of the layer of cold air.

Because seedlings receive more direct sunlight on south-facing slopes, seedling mortality generally is more severe on these slopes than on north-facing slopes. Various devices that provide artificial shade, such as shade cards, wood shingles, styrofoam cups, and rocks and debris, are effective in reducing the seedling mortality rate in some areas. The seedling survival rate generally is higher on north-facing slopes, which receive less direct sunlight and are cooler and more moist than south-facing slopes.

Topography is important in determining the degree of seedling mortality. In general, the seedling mortality rate is higher on the steeper south-facing slopes than on other slopes. It also commonly is higher in basins and nearly level areas where cold air can pool than in areas where air drainage is good.

The soil characteristics that influence seedling mortality include the content of rock fragments, depth, and texture. Coarse textured soils and soils that have a high content of rock fragments and a dark surface layer tend to reach higher temperatures, which result in a higher potential for seedling mortality. The characteristics that result in a higher available water capacity, such as a greater depth, a lower content of rock fragments, and medium texture, reduce the seedling mortality rate.

The damage to seedlings caused by insects, deer, elk, and rodents can be significant in some areas. The quality of the seedling stock and the experience of the planting crew also are important in determining the survival rate of seedlings.

Species vary in their susceptibility to the injury or death caused environmental factors. Ponderosa pine seedlings generally are more successful than Douglas fir seedlings if they are planted in areas where the seedling mortality rate is high as a result of a high temperature in the surface layer, moisture stress, or cold temperatures.

Compaction caused ground equipment used in harvesting and site preparation can reduce forest productivity and increase the hazards of erosion and sedimentation. Most soils are susceptible to compaction. The degree of compaction depends on such soil characteristics as the moisture content, the content of organic matter, the content of rock fragments, structure, and texture. It also depends on the load applied to the soils. Because only a few trips over the same area can cause significant compaction, machine traffic should be restricted to designated skid trails.

Erosion generally is not a problem in undisturbed areas. It is a hazard, however, in areas that have been logged, burned, or otherwise disturbed. The severity of the hazard depends on several factors, including the kind of soil, the slope, and the extent of surface disturbance.

Access roads are the most important source of runoff and stream sedimentation. Appropriate erosion-control practices and road maintenance procedures are needed to maintain the integrity of the roads and to prevent severe erosion and the resulting sedimentation of streams.

Recreation

Recreation is of major importance to the economy of the survey area. Outdoor activities, such as water sports, are growing in popularity. The Rogue, Applegate, and Klamath Rivers provide opportunities for rafting or kayaking on white water rapids. Fishing for salmon, steelhead, and trout is a major activity on the rivers and their tributaries. The mountain lakes and reservoirs in the area are popular sites for boating, waterskiing, and swimming. The reservoirs and other small water impoundments at the lower elevations support a warmwater sport fishery of bass and crappie.

Winter sports have grown in popularity in recent years. Mt. Ashland, which is a popular area for downhill and cross-country skiing, offers such facilities as lifts and a lodge. The Dead Indian Plateau is popular with cross-country skiers and snowmobilers.

Several areas that are noted for their scenic qualities attract many campers, hikers, and other nature enthusiasts. Visitors also have access to Crater Lake National Park and to the Sky Lakes and Mountain Lakes Wilderness Areas. The Pacific Crest Trail, a national scenic trail, traverses the High Cascades and the Klamath Mountains in the Mt. Ashland area. The Table Rocks area also is popular with hikers. The Bear Creek Greenway offers a greenbelt recreation site that is close to urban centers. Many public and private campgrounds are beside the various mountain lakes and streams in the survey area. Many wildlife species in the area are available for observing, photographing, and hunting.

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water

impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties generally are favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, or limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in table 9 and interpretations for septic tank absorption fields in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and other intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few, if any, stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

By Duane Setness, soil scientist, Soil Conservation Service.

The kinds and numbers of wildlife species in the survey area generally are related to the kinds of soil in the area. This relationship is indirect and is influenced mainly by the kinds of plant communities, climate, topography, and land use. Natural plant communities consist of a variety of vegetation, most of which is valuable to wildlife. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

The survey area is characterized by diverse environmental conditions that provide many types of wildlife habitat and therefore an abundance of wildlife species. The conditions in the area range from those of the warm, low-elevation flood plains and terraces in the central part of the area to those of the cold, high mountainous areas in the eastern part.

Water resources in the survey area include abundant ponds, lakes, and rivers, which provide high-quality habitat for many kinds of animals and fish. They also provide food and cover for many kinds of birds, including pheasant, valley quail, and migratory ducks and geese. Such animals as beaver and muskrat inhabit the streams and other water areas.

The Rogue River and its tributaries are used extensively by anadromous fish, such as coho salmon, chinook salmon, and steelhead trout. The number of anadromous fish in this river and its tributaries ranks second only to that in the Columbia River. Other fish include rainbow trout, cutthroat trout, warmwater game, and nongame fish, such as crappie, bass, catfish, and carp. Some areas are suitable for the construction of small fish ponds and other water impoundments.

Other wildlife that commonly inhabit this survey area include blacktail deer, mule deer, black bear, elk, bobcat, mountain lion, coyote, beaver, muskrat, mink, otter, weasel, skunk, raccoon, rabbit, rattlesnake, several kinds of squirrels, wood rats, mountain beaver, mice, moles, and gophers. The survey area has many kinds of resident and migrant birds, including hawks,

owls, quail, band-tailed pigeon, grouse, wild turkeys, ducks, geese, mourning dove, crows, jays, herons, bald eagle, osprey, and many kinds of woodpeckers, flycatchers, and songbirds. Several kinds of snakes, lizards, and salamanders also are common.

Much of the acreage in the survey area is used for cultivated crops, hay and pasture, or livestock grazing. The crops and the vegetation along fences and irrigation ditches provide some food and cover for wildlife. Urbanization, industrial development, and intensive agriculture have influenced wildlife populations in the central part of the survey area.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building Site Development, Sanitary Facilities, Construction Materials, and Water Management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of

the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 10 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table,

depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel, or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for

commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the taxonomic unit descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by the slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils generally is preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even more than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that

affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, the rate of water intake, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the thickness of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features listed in tables are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each taxonomic unit under "Taxonomic Units and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the system adopted by the American Association of State Highway and Transportation Officials *(1, 18)* and the Unified soil classification system *(2, 18)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits)

indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 14 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each taxonomic unit under "Taxonomic Units and Their Morphology."

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity; that is, the moisture content is at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the thickness of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design commonly is needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, more than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to

predict the average rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (as much as 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion.

Erosion factor T is an estimate of the maximum average rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 14, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Water Features

Table 15 gives estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflow from streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered to be flooding. Standing water in swamps and marshes or in closed depressional areas is considered to be ponding.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable, *rare* that it is unlikely but is possible under unusual weather conditions (the chance of flooding in any year is 0 to 5 percent), *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding in any year is 5 to 50 percent), and *frequent* that it occurs often under normal weather conditions (the chance of flooding in any year is more than 50 percent).

Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that flooding is most likely to occur is expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and level of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that

the water table usually is highest. A water table that is seasonally high for less than 1 month is not indicated in the table.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower water table by a dry zone.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Soil Features

Table 16 gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

A cemented pan is a cemented or indurated subsurface layer at a depth of 5 feet or less. Such a pan causes difficulty in excavation. Pans are classified as thin or thick. A *thin* pan is one that is less than 3 inches thick if continuously indurated or less than 18 inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A *thick* pan is one that is more than 3 inches thick if continuously indurated or more than 18 inches thick if it is discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(26)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 17 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Inceptisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquept (*Aqu*, meaning water, plus *ept*, from Inceptisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Cryaquepts (*Cry*, meaning cold temperatures, plus *aquept*, the suborder of the Inceptisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Cryaquepts.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, nonacid, Typic Cryaquepts.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Taxonomic Units and Their Morphology

In this section, each taxonomic unit recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each unit. A pedon, a small three-dimensional area of soil, that is typical of the unit in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(23)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(26)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the unit.

The map units of each taxonomic unit are described in the section "Detailed Soil Map Units."

Abegg Series

The Abegg series consists of very deep, well drained soils on alluvial fans. These soils formed in alluvium and colluvium derived from altered sedimentary and volcanic rock. Slopes are 2 to 12 percent. The mean

annual precipitation is about 35 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Abegg gravelly loam, 7 to 12 percent slopes, about 5 miles southwest of Applegate Store on the east side of Thompson Creek Road; about 2,700 feet north and 1,160 feet west of the southeast corner of sec. 7, T. 39 S., R. 4 W.

Oi—½ inch to 0; twigs, needles, and leaves.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) gravelly loam, light brownish gray (10YR 6/2) dry; strong medium and fine granular structure; soft, friable, nonsticky and nonplastic; common fine and very fine roots; many very fine, fine, and medium irregular pores; 25 percent gravel and 5 percent cobbles; slightly acid (pH 6.4); abrupt smooth boundary.

A2—5 to 13 inches; very dark grayish brown (10YR 3/2) very gravelly loam, light brownish gray (10YR 6/2) dry; moderate fine and very fine subangular blocky structure; soft, friable, nonsticky and nonplastic; common fine and very fine roots; many medium, fine, and very fine irregular pores; 45 percent gravel and 10 percent cobbles; slightly acid (pH 6.4); abrupt smooth boundary.

AB—13 to 22 inches; brown (10YR 4/3) very gravelly loam, very pale brown (10YR 7/3) dry; moderate fine and very fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine and medium roots; many fine and very fine irregular pores; 45 percent gravel and 10 percent cobbles; moderately acid (pH 6.0); clear smooth boundary.

BA—22 to 31 inches; dark yellowish brown (10YR 4/4) extremely gravelly loam, very pale brown (10YR 7/3) dry; moderate fine and very fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine and medium roots; common fine and very fine irregular pores; few faint patchy clay films; 60 percent gravel and 10 percent cobbles; moderately acid (pH 5.8); clear wavy boundary.

Bt1—31 to 38 inches; dark yellowish brown (10YR 4/6) extremely gravelly loam, very pale brown (10YR 7/3, 7/4) dry; moderate medium and fine subangular blocky structure; hard, friable, nonsticky and nonplastic; few fine, medium, and coarse roots; common fine and very fine irregular pores; common faint patchy clay films; 60 percent gravel and 10 percent cobbles; moderately acid (pH 5.8); clear wavy boundary.

Bt2—38 to 52 inches; brown (7.5YR 4/4) extremely gravelly clay loam, very pale brown (10YR 7/3, 7/4) dry; moderate medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; common fine and very fine irregular pores; continuous distinct brown (7.5YR 5/4) clay films; 50 percent gravel and 20 percent cobbles; moderately acid (pH 5.8); clear wavy boundary.

Bt3—52 to 66 inches; yellowish brown (10YR 5/4) extremely gravelly clay loam, very pale brown (10YR 7/3, 7/4) dry; moderate medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common fine and very fine irregular pores; continuous distinct strong brown (7.5YR 5/6) clay films; 50 percent gravel and 20 percent cobbles; moderately acid (pH 5.8).

The depth to bedrock is 60 inches or more. The particle-size control section contains 40 to 70 percent rock fragments and 25 to 35 percent clay.

The A horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 3 to 7 dry; and chroma of 2 to 4 moist and dry. The Bt horizon has hue of 10YR or 7.5YR; value of 3 to 5 moist, 4 to 7 dry; and chroma of 3 to 6 moist and dry. It is very gravelly clay loam, very gravelly loam, extremely gravelly clay loam, extremely gravelly loam, or extremely cobbly clay loam. Some pedons have a C horizon below a depth of 40 inches. This horizon is very gravelly sandy loam, extremely gravelly loamy sand, or extremely cobbly sandy loam.

Abin Series

The Abin series consists of very deep, moderately well drained soils on flood plains. These soils formed in alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Abin silty clay loam, 0 to 3 percent slopes, about 2 miles southwest of Eagle Point; about 150 feet east and 50 feet south of the northwest corner of sec. 9, T. 36 S., R. 1 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine roots; many very fine irregular pores; neutral (pH 6.6); abrupt smooth boundary.

A1—10 to 18 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; hard, friable, sticky and plastic; common very fine and fine roots; many irregular pores; neutral (pH 6.8); clear smooth boundary.

A2—18 to 34 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry;

weak medium subangular blocky structure parting to moderate fine granular; hard, friable, sticky and plastic; common very fine and fine roots; many very fine irregular pores; neutral (pH 6.8); clear wavy boundary.

AC—34 to 44 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to moderate fine granular; hard, friable, sticky and plastic; common very fine and fine roots; many very fine irregular pores; neutral (pH 7.0); clear wavy boundary.

C—44 to 65 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; common fine distinct strong brown (7.5YR 4/6) and yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; hard, friable, very sticky and plastic; few fine roots; many very fine tubular pores; neutral (pH 7.0).

The depth to bedrock is 60 inches or more. The particle-size control section contains 35 to 45 percent clay. The mollic epipedon is 20 to 40 inches thick. The soils are characterized by an irregular decrease in content of organic carbon to a depth of 50 inches.

The upper part of the A horizon has value of 2 or 3 moist, 3 to 5 dry, and chroma of 1 or 2 moist and dry. The lower part of the A horizon and the AC horizon have value of 2 or 3 moist, 3 to 5 dry, and chroma of 1 to 3 moist and dry. They are silty clay loam, clay, or silty clay. The C horizon has value of 3 or 4 moist, 4 or 5 dry, and chroma of 2 or 3 moist and dry.

Acker Series

The Acker series consists of very deep, well drained soils on ridges and hillslopes. These soils formed in colluvium and residuum derived from altered sedimentary and volcanic rock. Slopes are 12 to 55 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Acker gravelly loam, in an area of Norling-Acker complex, 35 to 55 percent south slopes, near Waggoner Gap; about 900 feet east and 300 feet south of the northwest corner of sec. 3, T. 33 S., R. 4 W.

Oi—4 inches to 0; bark, leaves, needles, roots, and twigs.

A—0 to 8 inches; brown (10YR 4/3) gravelly loam, brown (10YR 5/3) dry; strong very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and common fine, medium, and coarse roots; many very fine irregular pores; 30 percent gravel and 4 percent cobbles; strongly acid (pH 5.2); clear smooth boundary.

BA—8 to 17 inches; yellowish brown (10YR 5/4) gravelly clay loam, brownish yellow (10YR 6/6) dry; strong very fine and fine subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine, fine, medium, and coarse roots; many very fine tubular pores; 15 percent gravel; strongly acid (pH 5.2); clear wavy boundary.

Bt1—17 to 28 inches; yellowish red (5YR 5/6) gravelly clay loam, strong brown (7.5YR 5/6) dry; strong very fine and fine subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine and few medium and coarse roots; many very fine tubular pores; common distinct clay films on faces of peds and in pores; 15 percent gravel; strongly acid (pH 5.2); gradual wavy boundary.

Bt2—28 to 60 inches; strong brown (7.5YR 5/6, 5/8) gravelly clay loam, reddish yellow (7.5YR 6/8) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine and fine roots; common very fine tubular pores; common distinct clay films on faces of peds and in pores; 20 percent gravel and 5 percent cobbles; strongly acid (pH 5.2).

The depth to bedrock is 60 inches or more. The particle-size control section contains 20 to 35 percent clay and 5 to 35 percent rock fragments.

The A horizon has hue of 10YR or 7.5YR; value of 2 to 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist, 3 or 4 dry. The Bt horizon has hue of 10YR, 7.5YR, 5YR, or 2.5Y; value of 3 to 5 moist, 4 to 6 dry; and chroma of 3 to 8 moist and dry. It is gravelly clay loam or clay loam.

Agate Series

The Agate series consists of well drained soils on fan terraces. These soils are moderately deep to a duripan. They formed in stratified alluvium. Slopes are 0 to 15 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Agate loam, in an area of Agate-Winlo complex, 0 to 5 percent slopes, about 500 feet west and 200 feet south of the intersection of Table Rock Road and Kirtland Road; about 1,150 feet east and 400 feet north of the southwest corner of sec. 13, T. 36 S., R. 2 W.

A—0 to 6 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; moderate medium and fine subangular blocky and strong very fine granular structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; 10 percent

gravel; slightly acid (pH 6.2); clear smooth boundary.

BA—6 to 12 inches; dark yellowish brown (10YR 3/4) clay loam, dark yellowish brown (10YR 4/4) dry; weak medium subangular blocky structure; hard, friable, sticky and plastic; many very fine and fine roots; many very fine irregular pores; 10 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

Bw1—12 to 20 inches; dark brown (7.5YR 3/4) clay loam, brown (7.5YR 4/4) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots; common very fine tubular pores; 10 percent gravel; moderately acid (pH 6.0); clear smooth boundary.

Bw2—20 to 25 inches; dark brown (7.5YR 3/4) clay loam, brown (7.5YR 4/4) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; few fine roots; common very fine tubular pores; 10 percent gravel; moderately acid (pH 5.8); abrupt smooth boundary.

2Bqm—25 to 30 inches; yellowish red (5YR 4/6) and red (2.5YR 4/6) duripan, yellowish red (5YR 5/6) and reddish yellow (5YR 6/6) dry; massive; nearly continuous, cemented silica laminae; common fine black stains; 40 percent gravel and 20 percent cobbles; clear smooth boundary.

2C1—30 to 49 inches; light olive brown (2.5YR 5/4) extremely gravelly coarse sandy loam, very pale brown (10YR 7/4) and yellow (10YR 7/6) dry; massive; slightly hard, very friable, nonsticky and nonplastic; discontinuous, weakly cemented laminae or rock fragments; 55 percent gravel and 25 percent cobbles; neutral (pH 6.6); gradual smooth boundary.

2C2—49 to 62 inches; light olive brown (2.5YR 5/4) extremely gravelly coarse sandy loam, pale yellow (2.5YR 7/4) dry; massive; slightly hard, very friable, nonsticky and nonplastic; 55 percent gravel and 25 percent cobbles; neutral (pH 6.6).

The depth to a duripan is 20 to 30 inches. The depth to bedrock is 60 inches or more. The particle-size control section contains 10 to 30 percent rock fragments and 18 to 35 percent clay.

The A horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 4 or 5 dry; and chroma of 2 to 4 moist and dry. The Bw horizon has hue of 7.5YR or 5YR and value of 3 or 4 moist, 4 to 6 dry. It generally is clay loam, loam, or gravelly loam. The 2C horizon has hue of 2.5YR to 5YR; value of 4 to 6 moist, 6 or 7 dry; and chroma of 4 or 5 moist, 4 to 6 dry. It generally is extremely gravelly coarse sandy loam or extremely gravelly loamy sand and contains 40 to 60 percent gravel and 10 to 30 percent cobbles. In some pedons it has strata of loam or silt loam. The duripan is indurated in some parts and is weakly cemented or strongly cemented in the remaining parts. Cementation is discontinuous and weak below the duripan.

Alcot Series

The Alcot series consists of very deep, somewhat excessively drained soils on plateaus and hillslopes. These soils formed in volcanic ash and pumice. Slopes are 1 to 35 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Alcot gravelly sandy loam, in an area of Crater Lake-Alcot complex, 1 to 12 percent slopes, within 1 mile of Prospect; about 1,500 feet east and 1,100 feet south of the northwest corner of sec. 32, T. 32 S., R. 3 E.

Oi—2 inches to 0; needles, twigs, and moss.

A—0 to 4 inches; brown (10YR 4/3) gravelly sandy loam, pale brown (10YR 6/3) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; many very fine irregular pores; 20 percent gravel and 5 percent cobbles; slightly acid (pH 6.4); abrupt smooth boundary.

Bw—4 to 11 inches; brown (7.5YR 4/4) gravelly sandy loam, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; many very fine irregular pores; 20 percent gravel and 10 percent cobbles; moderately acid (pH 5.6); abrupt wavy boundary.

C1—11 to 44 inches; dark yellowish brown (10YR 4/6) very cobbly sandy loam, light yellowish brown (10YR 6/4) dry; massive; soft, very friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; many very fine irregular pores; 25 percent gravel and 30 percent cobbles; moderately acid (pH 5.6); abrupt wavy boundary.

C2—44 to 60 inches; olive brown (2.5Y 4/4) very cobbly sandy loam, light gray (2.5Y 7/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; few very fine, fine, and medium roots; common very fine irregular pores; 25 percent gravel and 30 percent cobbles; moderately acid (pH 5.6).

The depth to bedrock is 60 inches or more. The solum is 10 to 25 inches thick. The profile consists of volcanic ash and gravel- and cobble-sized pumice fragments. The particle-size control section contains 15 to 35 percent gravel-sized pumice fragments and 20 to 35 percent cobble-sized pumice fragments. It has a bulk

density of 0.75 to 0.90 gram per cubic centimeter.

The A horizon has hue of 7.5YR or 10YR; value of 3 or 4 moist, 5 or 6 dry; and chroma of 2 to 4 moist and dry. The Bw horizon has hue of 7.5YR or 10YR; value of 3 to 5 moist, 6 or 7 dry; and chroma of 3 or 4 moist and dry. The C horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 4 or 5 moist, 6 or 7 dry; and chroma of 3 to 6 moist, 2 to 4 dry. It is very cobbly sandy loam, very cobbly loamy sand, or extremely cobbly loamy sand. Stratification is common below a depth of 40 inches.

Aspenlake Series

The Aspenlake series consists of well drained soils on alluvial fans. These soils are moderately deep to a duripan. They formed in alluvium derived from andesite and basalt. Slopes are 1 to 12 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 42 degrees F.

Typical pedon of Aspenlake stony loam, in an area of Aspenlake-Whiteface complex, 1 to 12 percent slopes, north of Aspen Lake; about 2,200 feet west and 1,600 feet south of the northeast corner of sec. 17, T. 37 S., R. 7 E.

A1—0 to 4 inches; dark brown (7.5YR 3/2) stony loam, brown (10YR 5/3) dry; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine, common fine and medium, and few coarse roots; many very fine irregular pores; 10 percent gravel, 5 percent cobbles, and 5 percent stones; moderately acid (pH 5.6); clear smooth boundary.

A2—4 to 10 inches; dark brown (7.5YR 3/3) gravelly loam, brown (10YR 5/3) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, common fine and medium, and few coarse roots; many very fine irregular pores; 10 percent gravel and 5 percent cobbles; moderately acid (pH 5.6); abrupt wavy boundary.

Bw—10 to 26 inches; dark brown (7.5YR 3/3) gravelly loam, pale brown (10YR 6/3) dry; moderate very fine and fine angular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and few fine, medium, and coarse roots; many very fine irregular pores; 15 percent gravel and 5 percent cobbles; moderately acid (pH 5.8); abrupt wavy boundary.

2Bqm—26 to 60 inches; strongly cemented, gravelly duripan.

The depth to a strongly cemented duripan is 20 to 40 inches. The depth to bedrock is 60 inches or more. The particle-size control section contains 12 to 18 percent clay and 15 to 35 percent rock fragments.

The A horizon has hue of 10YR or 7.5YR; value of 2 or 3 moist, 4 or 5 dry; and chroma of 2 or 3 moist and dry. The Bw horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 or 3 moist and dry.

Atring Series

The Atring series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from altered sedimentary and volcanic rock. Slopes are 50 to 80 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Atring very gravelly loam, in an area of Kanid-Atring very gravelly loams, 50 to 80 percent north slopes, about 13.5 miles north of Wimer; about 1,400 feet west and 2,450 feet south of the northeast corner of sec. 2, T. 33 S., R. 4 W.

Oi—1 inch to 0; needles, leaves, twigs, and roots.

A—0 to 7 inches; very dark brown (10YR 2/2) very gravelly loam, dark grayish brown (10YR 4/2) dry; moderate very fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine, fine, and medium and common coarse roots; many very fine and fine irregular pores; 45 percent gravel and 5 percent cobbles; moderately acid (pH 5.6); abrupt smooth boundary.

Bw1—7 to 24 inches; brown (10YR 4/3) very gravelly loam, yellowish brown (10YR 5/4) dry; moderate very fine and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many fine irregular pores; 30 percent gravel and 5 percent cobbles; moderately acid (pH 5.6); gradual wavy boundary.

Bw2—24 to 40 inches; yellowish brown (10YR 5/4) very gravelly loam, light yellowish brown (10YR 6/4) dry; moderate very fine and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine irregular pores; 35 percent gravel and 10 percent cobbles; strongly acid (pH 5.4); gradual wavy boundary.

Cr—40 inches; highly fractured, metavolcanic bedrock.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 60 percent rock fragments and 15 to 30 percent clay.

The A horizon has hue of 10YR or 7.5YR; value of 2 to 5 moist, 4 to 7 dry; and chroma of 2 to 4 moist and

dry. The Bw horizon has hue of 10YR or 7.5YR; value of 3 to 5 moist, 5 to 7 dry; and chroma of 3 to 6 moist and dry. It is very gravelly loam, very gravelly clay loam, or very gravelly silt loam.

Barhiskey Series

The Barhiskey series consists of very deep, excessively drained soils on outwash plains. These soils formed in sandy alluvium mixed with pumice and volcanic ash. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Barhiskey gravelly loamy sand, 0 to 3 percent slopes, about 4 miles northeast of Prospect; about 2,200 feet west and 1,575 feet north of the southeast corner of sec. 14, T. 32 S., R. 3 E.

Oi—1 inch to 0; needles and twigs.

A—0 to 4 inches; black (10YR 2/1) gravelly loamy sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and common medium and coarse roots; many very fine irregular pores; 20 percent gravel; moderately acid (pH 5.6); abrupt smooth boundary.

AC—4 to 19 inches; dark brown (10YR 3/3) gravelly sand, brown (10YR 5/3) dry; single grain; loose, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; common very fine and fine irregular pores; 25 percent gravel and 5 percent cobbles; moderately acid (pH 6.0); abrupt wavy boundary.

C1—19 to 39 inches; very dark gray (10YR 3/1) gravelly sand, dark grayish brown (10YR 4/2) dry; single grain; loose, nonsticky and nonplastic; few roots; common very fine and fine irregular pores; 20 percent gravel; slightly acid (pH 6.4); gradual wavy boundary.

C2—39 to 60 inches; very dark gray (10YR 3/1) gravelly sand, dark grayish brown (10YR 4/2) dry; single grain; loose, nonsticky and nonplastic; few roots; common very fine and fine irregular pores; 30 percent gravel; moderately acid (pH 5.6).

The depth to bedrock is 60 inches or more. The particle-size control section is sand and contains 20 to 35 percent rock fragments. The umbric epipedon is 10 to 20 inches thick.

The A horizon has value of 2 or 3 moist, 4 or 5 dry, and chroma of 1 or 2 moist, 2 or 3 dry. The AC horizon has value of 4 or 5 dry and chroma of 2 or 3 dry. The C horizon has value of 4 or 5 dry and chroma of 1 or 2 moist.

Barhiskey Variant

The Barhiskey Variant consists of very deep, somewhat poorly drained soils on outwash plains. These soils formed in sandy alluvium mixed with pumice and volcanic ash. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Barhiskey Variant gravelly loamy sand, 0 to 3 percent slopes, about 1.5 miles northeast of Prospect; about 2,600 feet east and 250 feet north of the southwest corner of sec. 22, T. 32 S., R. 3 E.

Oi—1 inch to 0; needles and twigs.

A1—0 to 3 inches; black (10YR 2/1) gravelly loamy sand, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; loose, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine irregular pores; 20 percent gravel; moderately acid (pH 5.8); abrupt smooth boundary.

A2—3 to 8 inches; black (10YR 2/1) gravelly loamy sand, dark grayish brown (10YR 4/2) dry; moderate fine and medium subangular blocky structure; loose, nonsticky and nonplastic; common very fine, fine, and medium roots; common very fine and fine irregular pores; 20 percent gravel; moderately acid (pH 5.6); abrupt wavy boundary.

AC—8 to 29 inches; very dark grayish brown (10YR 3/2) gravelly sand, grayish brown (10YR 5/2) dry; common large prominent strong brown (7.5YR 4/6, 5/6) mottles; weak very fine and fine subangular blocky structure; loose, nonsticky and nonplastic; few very fine and fine roots; common very fine and fine irregular pores; 25 percent gravel; moderately acid (pH 5.8); gradual wavy boundary.

C—29 to 60 inches; very dark gray (10YR 3/1) gravelly sand, grayish brown (10YR 5/2) dry; common large prominent strong brown (7.5YR 4/6, 5/6) mottles; single grain; loose, nonsticky and nonplastic; few very fine and fine roots; common very fine and fine irregular pores; 30 percent gravel; moderately acid (pH 5.8).

The depth to bedrock is 60 inches or more. The particle-size control section is sand and contains 20 to 35 percent rock fragments.

The A and AC horizons have value of 2 or 3 moist, 4 or 5 dry, and chroma of 1 or 2 moist and dry. The C horizon has value of 2 to 4 moist, 4 to 6 dry, and chroma of 1 or 2 moist and dry.

Barron Series

The Barron series consists of very deep, somewhat excessively drained soils on alluvial fans. These soils

formed in alluvium derived from granitic rock. Slopes are 0 to 12 percent. The mean annual precipitation is about 25 inches, and the mean annual temperature is about 52 degrees F.

Typical pedon of Barron coarse sandy loam, 0 to 7 percent slopes, about 1.5 miles southwest of Wimer; about 1,650 feet east and 950 feet north of the southwest corner of sec. 15, T. 35 S., R. 4 W.

A—0 to 6 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine irregular pores; 2 percent gravel; strongly acid (pH 5.4); abrupt smooth boundary.

Bw—6 to 23 inches; brown (10YR 4/3) sandy loam, light yellowish brown (10YR 6/4) dry; weak coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots; many very fine tubular pores; 2 percent gravel; moderately acid (pH 5.6); clear wavy boundary.

C1—23 to 37 inches; dark yellowish brown (10YR 4/4) sandy loam, light yellowish brown (10YR 6/4) dry; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; hard, friable, nonsticky and nonplastic; few very fine roots; common very fine tubular pores; 2 percent gravel; moderately acid (pH 5.8); gradual wavy boundary.

C2—37 to 60 inches; brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; massive; hard, friable, slightly sticky and nonplastic; few very fine roots; common very fine tubular pores; 2 percent gravel; moderately acid (pH 5.6).

The depth to bedrock is 60 inches or more. The particle-size control section contains 8 to 18 percent clay.

The A horizon has hue of 10YR or 2.5Y; value of 3 or 4 moist, 5 to 7 dry; and chroma of 2 or 3 moist and dry. The Bw horizon has hue of 10YR or 2.5Y; value of 4 or 5 moist, 6 or 7 dry; and chroma of 3 to 6 moist, 3 to 5 dry. It is coarse sandy loam or sandy loam. The C horizon has hue of 10YR or 2.5Y; value of 4 or 5 moist, 6 or 7 dry; and chroma of 2 to 6 moist and dry. It is coarse sandy loam or sandy loam.

Beekman Series

The Beekman series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from altered sedimentary and volcanic rock. Slopes are 50 to 80 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Beekman gravelly loam, in an area of Beekman-Colestine gravelly loams, 50 to 80 percent north slopes, about 3 miles southeast of Wimer; about 1,000 feet north and 2,400 feet west of the southeast corner of sec. 25, T. 35 S., R. 4 W.

A—0 to 5 inches; dark brown (10YR 3/3) gravelly loam, brown (10YR 4/3) dry; weak fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine irregular pores; 25 percent gravel; slightly acid (pH 6.5); clear smooth boundary.

AB—5 to 14 inches; dark brown (10YR 3/3) gravelly loam, brown (10YR 5/3) dry; weak fine and very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common medium and coarse and few fine and very fine roots; many fine irregular pores; 25 percent gravel; slightly acid (pH 6.2); clear wavy boundary.

Bw—14 to 28 inches; grayish brown (2.5Y 5/2) extremely gravelly loam, light brownish gray (2.5Y 6/2) dry; weak fine and very fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few fine and very fine roots; many very fine irregular pores; 70 percent gravel; slightly acid (pH 6.4); clear wavy boundary.

R—28 inches; fractured, metamorphosed sedimentary bedrock.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 70 percent rock fragments and 18 to 30 percent clay.

The A horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist, 3 or 4 dry. The Bw horizon has hue of 2.5Y, 10YR, or 7.5YR; value of 4 or 5 moist, 5 to 7 dry; and chroma of 2 to 4 moist and dry. It is very gravelly loam, very gravelly clay loam, or extremely gravelly loam.

Bly Series

The Bly series consists of very deep, well drained soils on plateaus and hillslopes. These soils formed in sediment weathered from andesite and containing small amounts of volcanic ash. Slopes are 1 to 35 percent. The mean annual precipitation is about 20 inches, and the mean annual temperature is about 44 degrees F.

Typical pedon of Bly loam, in an area of Bly-Royst complex, 12 to 35 percent slopes, about 5.5 miles west of Keno; about 1,550 feet south and 2,200 feet east of the northwest corner of sec. 31, T. 39 S., R. 7 E.

Oi—3 inches to 0; needles, twigs, and roots.

A—0 to 17 inches; very dark brown (10YR 2/2) loam, brown (10YR 4/3) dry; moderate very fine and fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; common very fine tubular pores; slightly acid (pH 6.2); clear wavy boundary.

Bt1—17 to 36 inches; dark brown (7.5YR 3/3) clay loam, yellowish brown (10YR 5/4) dry; moderate very fine and fine angular blocky structure; hard, friable, sticky and plastic; common very fine and few fine, medium, and coarse roots; many very fine tubular pores; common faint clay films on faces of peds and in pores; slightly acid (pH 6.2); clear wavy boundary.

Bt2—36 to 60 inches; dark yellowish brown (10YR 3/4) clay loam, yellowish brown (10YR 5/4) dry; weak medium subangular blocky structure; hard, friable, sticky and plastic; few very fine, fine, and medium roots; many very fine tubular pores; few faint clay films on faces of peds and in pores; 13 percent gravel; slightly acid (pH 6.2).

The depth to bedrock is 60 inches or more. The particle-size control section contains 27 to 35 percent clay and 10 to 35 percent rock fragments. The mollic epipedon is 20 to 30 inches thick.

The A horizon has value of 2 or 3 moist, 4 or 5 dry, and chroma of 2 or 3 moist and dry. The Bt horizon has hue of 10YR or 7.5YR; value of 3 to 5 moist, 5 or 6 dry; and chroma of 3 or 4 moist, 2 to 4 dry. It is clay loam or gravelly clay loam.

Bogus Series

The Bogus series consists of very deep, well drained soils on hillslopes. These soils formed in colluvium and residuum derived from igneous rock. Slopes are 1 to 65 percent. The mean annual precipitation is about 25 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Bogus very gravelly loam, 35 to 65 percent north slopes, about 1 mile southeast of Pilot Rock; about 650 feet south and 550 feet west of the northeast corner of sec. 12, T. 41 S., R. 2 E.

Oi—1 inch to 0; needles, leaves, and twigs.

A1—0 to 2 inches; black (10YR 2/1) very gravelly loam, very dark grayish brown (10YR 3/2) dry; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine irregular pores; 45 percent gravel; slightly acid (pH 6.4); abrupt smooth boundary.

A2—2 to 7 inches; black (10YR 2/1) very gravelly loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine irregular pores; 35 percent gravel; slightly acid (pH 6.5); clear smooth boundary.

A3—7 to 15 inches; very dark grayish brown (10YR 3/2) very gravelly loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine irregular pores; 35 percent gravel; slightly acid (pH 6.5); clear smooth boundary.

BA—15 to 21 inches; dark brown (10YR 3/3) gravelly clay loam, brown (10YR 4/3) dry; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots; many very fine irregular and few very fine tubular pores; 20 percent gravel; slightly acid (pH 6.5); clear smooth boundary.

Bt1—21 to 48 inches; dark yellowish brown (10YR 3/4) clay loam, dark yellowish brown (10YR 4/4) dry; moderate fine and medium subangular blocky structure; hard, firm, very sticky and very plastic; common fine and medium roots; common very fine tubular pores; common distinct clay films on faces of peds and in pores; 10 percent gravel; slightly acid (pH 6.5); gradual wavy boundary.

Bt2—48 to 65 inches; dark brown (7.5YR 3/4) clay loam, brown (7.5YR 4/4) dry; moderate fine and medium subangular blocky structure; hard, firm, very sticky and plastic; few medium roots; common very fine and fine tubular pores; few distinct clay films on faces of peds and in pores; 5 percent gravel; slightly acid (pH 6.5).

The depth to bedrock is 60 inches or more. The particle-size control section contains 35 to 45 percent clay and 5 to 15 percent rock fragments. The mollic epipedon is 20 to 25 inches thick.

The A horizon has hue of 10YR or 7.5YR; value of 2 or 3 moist, 3 or 4 dry; and chroma of 1 to 3 moist and dry. The Bt horizon has hue of 10YR or 7.5YR; value of 3 to 5 moist, 3 to 6 dry; and chroma of 3 to 6 moist and dry. It is clay loam or clay.

Booth Series

The Booth series consists of moderately deep, well drained soils on plateaus. These soils formed in colluvium derived from igneous rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 18 inches, and the mean annual temperature is about 44 degrees F.

Typical pedon of Booth loam, in an area of Booth-Kanutchan Variant complex, 0 to 3 percent slopes;

about 150 feet east and 1,850 feet north of the southwest corner of sec. 11, T. 41 S., R. 6 E.

A1—0 to 5 inches; dark brown (7.5YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate thin to very thick platy structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine and medium tubular pores; 5 percent gravel; slightly acid (pH 6.2); abrupt smooth boundary.
A2—5 to 15 inches; dark brown (7.5YR 3/2) loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; common very fine, fine, and medium tubular pores; 5 percent gravel; slightly acid (pH 6.4); abrupt wavy boundary.
2Bt1—15 to 26 inches; brown (10YR 4/3) clay, brown (10YR 5/3) dry; strong medium prismatic structure; very hard, very firm, very sticky and very plastic; few very fine roots; common very fine tubular pores; continuous prominent clay films on faces of peds and in pores; neutral (pH 6.7); clear smooth boundary.
2Bt2—26 to 35 inches; dark yellowish brown (10YR 4/4) clay, light yellowish brown (10YR 6/4) dry; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, very firm, sticky and plastic; few very fine roots; common very fine tubular pores; continuous prominent clay films on faces of peds and in pores; neutral (pH 6.7); clear smooth boundary.
3Cr—35 to 37 inches; decomposed tuff.
3R—37 inches; tuff.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 45 to 60 percent clay. The content of clay increases by at least 20 percent at the upper boundary of the argillic horizon. The mollic epipedon is 7 to 15 inches thick.

The A horizon has hue of 10YR or 7.5YR; value of 2 or 3 moist, 3 to 5 dry; and chroma of 1 to 3 moist and dry. The 2Bt horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 2 to 4 moist, 3 to 6 dry; and chroma of 2 to 4 moist and dry. It is clay or silty clay.

Brader Series

The Brader series consists of shallow, well drained soils on knolls and ridges. These soils formed in colluvium derived from sandstone. Slopes are 1 to 40 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Brader loam, in an area of Brader-Debenger loams, 1 to 15 percent slopes, about 1.5 miles northeast of the community of Sams Valley; about 250 feet south of a logging road; 1,575 feet east and 785 feet south of the northwest corner of sec. 28, T. 35 S., R. 2 W.

A—0 to 6 inches; dark brown (7.5YR 3/2) loam, light brown (7.5YR 6/4) dry; weak fine subangular blocky structure parting to moderate very fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and few medium roots; many irregular pores; neutral (pH 6.8); clear smooth boundary.
Bw—6 to 13 inches; dark reddish brown (5YR 3/4) loam, light brown (7.5YR 6/4) dry; moderate fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many very fine tubular pores; neutral (pH 6.7); abrupt smooth boundary.
Cr—13 inches; saprolitic sandstone; few black (10YR 2/1) stains in fractures.

The depth to bedrock and the thickness of the solum are 12 to 20 inches. The particle-size control section contains 20 to 35 percent clay and 5 to 25 percent rock fragments.

The A horizon has hue of 7.5YR or 10YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist. The Bw horizon has hue of 5YR, 7.5YR, or 10YR and value of 3 or 4 moist, 4 to 6 dry. It is loam, clay loam, or gravelly loam.

Bybee Series

The Bybee series consists of very deep, somewhat poorly drained soils on plateaus and hillslopes. These soils formed in colluvium derived from igneous rock. Slopes are 1 to 35 percent. The mean annual precipitation is about 40 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Bybee loam, in an area of Bybee-Tatouche complex, 12 to 35 percent south slopes, about 0.25 mile northeast of Shale City; about 1,525 feet north and 450 feet west of the southeast corner of sec. 9, T. 38 S., R. 2 E.

Oi—½ inch to 0; needles, leaves, twigs, and roots.
A1—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, dark brown (10YR 5/2) dry; moderate fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and common medium roots; many irregular pores; 5 percent gravel and 5 percent cobbles; slightly acid (pH 6.5); abrupt smooth boundary.
A2—4 to 10 inches; very dark grayish brown (10YR 3/2)

clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; many fine and common medium roots; many very fine tubular pores; 5 percent gravel and 5 percent cobbles; slightly acid (pH 6.4); abrupt smooth boundary.

2Bw1—10 to 14 inches; brown (10YR 4/3) clay, brown (10YR 4/3) dry; weak medium and coarse subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few medium and coarse roots; many very fine tubular pores; 5 percent gravel and 5 percent cobbles; moderately acid (pH 6.0); gradual wavy boundary.

2Bw2—14 to 38 inches; light yellowish brown (2.5Y 6/4) clay, variegated light gray (2.5Y 7/2) and light yellowish brown (2.5Y 6/4) dry; weak medium and coarse angular blocky structure; massive when wet; extremely hard, extremely firm, very sticky and very plastic; few medium and coarse roots; many very fine tubular pores; 5 percent cobbles; moderately acid (pH 6.0); gradual wavy boundary.

2C—38 to 60 inches; variegated light yellowish brown (2.5Y 6/4) clay, variegated light gray (2.5Y 7/2) and light yellowish brown (2.5Y 6/4) dry; massive; extremely hard, extremely firm, very sticky and very plastic; 5 percent gravel and cobbles; moderately acid (pH 5.6).

The depth to bedrock is 60 inches or more. The particle-size control section contains 40 to 55 percent clay and 5 to 25 percent rock fragments.

The A horizon has hue of 10YR or 7.5YR; value of 2 or 3 moist, 4 or 5 dry; and chroma of 2 or 3 moist and dry. In many pedons a stone line is at the lower boundary of this horizon. The 2Bw and 2C horizons have hue of 2.5Y or 10YR, value of 4 to 7 moist and dry, and chroma of 2 to 4 moist and dry. They are clay or gravelly clay.

Camas Series

The Camas series consists of very deep, excessively drained soils on flood plains. These soils formed in gravelly alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 52 degrees F.

Typical pedon of Camas sandy loam, 0 to 3 percent slopes, about 1.5 miles southeast of Lower Table Rock; about 1,610 feet south and 1,320 feet west of the northeast corner of sec. 15, T. 36 S., R. 2 W.

Ap—0 to 10 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; single grain; soft, very friable, nonsticky and nonplastic; many fine irregular pores; slightly acid (pH 6.5); abrupt smooth boundary.

C1—10 to 19 inches; very dark grayish brown (10YR 3/2) very gravelly loamy sand, brown (10YR 5/3) dry; single grain; soft, very friable, nonsticky and nonplastic; many fine irregular pores; 35 percent gravel; slightly acid (pH 6.5); clear smooth boundary.

C2—19 to 60 inches; very dark grayish brown (10YR 3/2) extremely gravelly coarse sand, dark grayish brown (10YR 4/2) dry; single grain; loose, nonsticky and nonplastic; many fine irregular pores; 50 percent gravel and 20 percent cobbles; slightly acid (pH 6.5).

The depth to bedrock is 60 inches or more. The particle-size control section contains 35 to 80 percent rock fragments. It is coarse sand, sand, or loamy sand. The mollic epipedon is 10 to 14 inches thick.

The A horizon has hue of 10YR or 7.5YR; value of 2 or 3 moist, 4 or 5 dry; and chroma of 2 or 3 moist and dry. It is gravelly sandy loam or sandy loam. The C horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist and dry. It is extremely gravelly coarse sand, very gravelly sand, or very gravelly loamy sand.

Campfour Series

The Campfour series consists of very deep, well drained soils on plateaus and hillslopes. These soils formed in residuum and colluvium derived from igneous rock. Slopes are 1 to 35 percent. The mean annual precipitation is about 23 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Campfour loam, in an area of Campfour-Paragon complex, 1 to 12 percent slopes; about 800 feet south and 1,500 feet east of the northwest corner of sec. 1, T. 41 S., R. 5 E.

Oi—1 inch to 0; needles and twigs.

A—0 to 5 inches; dark reddish brown (5YR 3/2) loam, reddish brown (5YR 4/3) dry; strong very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and common fine, medium, and coarse roots; many very fine irregular pores; 9 percent gravel and 5 percent cobbles; moderately acid (pH 5.8); clear smooth boundary.

AB—5 to 21 inches; dark reddish brown (5YR 3/3) loam, reddish brown (5YR 4/4) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and common fine, medium, and coarse roots; many very fine tubular pores; 9 percent gravel and

5 percent cobbles; moderately acid (pH 5.6); clear wavy boundary.

Bt1—21 to 50 inches; dark reddish brown (5YR 3/3) clay loam, reddish brown (5YR 4/4) dry; moderate very fine and fine angular blocky structure; hard, firm, sticky and plastic; common very fine and few fine, medium, and coarse roots; common very fine tubular pores; common faint clay films on faces of peds and in pores; 10 percent gravel; moderately acid (pH 5.6); gradual wavy boundary.

Bt2—50 to 60 inches; dark reddish brown (5YR 3/4) gravelly clay loam, reddish brown (5YR 4/4) dry; moderate very fine and fine angular blocky structure; hard, firm, sticky and plastic; few very fine, fine, and medium roots; common very fine tubular pores; common faint clay films on faces of peds and in pores; 15 percent gravel; moderately acid (pH 5.6).

The depth to bedrock is 60 inches or more. The particle-size control section contains 27 to 35 percent clay and 5 to 35 percent rock fragments. The mollic epipedon is 20 to 40 inches thick.

The A horizon has hue of 7.5YR, 5YR, or 2.5YR; value of 2 or 3 moist; and chroma of 2 or 3 moist, 3 or 4 dry. The Bt horizon has hue of 5YR or 2.5YR and chroma of 3 or 4 moist and dry. It is clay loam, gravelly clay loam, or cobbly clay loam.

Caris Series

The Caris series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from altered sedimentary and volcanic rock. Slopes are 50 to 80 percent. The mean annual precipitation is about 32 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Caris gravelly loam, in an area of Caris-Offenbacher gravelly loams, 50 to 80 percent north slopes, about 3 miles southeast of Ruch; about 380 feet west and 500 feet south of the northeast corner of sec. 31, T. 38 S., R. 2 W.

Oi—1 inch to 0; needles and twigs.

A—0 to 7 inches; very dark grayish brown (10YR 3/2) gravelly loam, light brownish gray (10YR 6/2) dry; strong medium and fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many irregular pores; 30 percent gravel; neutral (pH 6.8); abrupt smooth boundary.

BA—7 to 12 inches; dark yellowish brown (10YR 3/4) very gravelly clay loam, pale brown (10YR 6/3) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many irregular pores; 30 percent gravel and 15 percent cobbles; neutral (pH 6.6); clear smooth boundary.

Bw1—12 to 20 inches; dark yellowish brown (10YR 4/4) very gravelly clay loam, light yellowish brown (10YR 6/4) dry; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and plastic; many very fine and fine roots; many irregular pores; 40 percent gravel and 15 percent cobbles; neutral (pH 6.6); clear wavy boundary.

Bw2—20 to 31 inches; dark yellowish brown (10YR 4/4) extremely gravelly loam, light yellowish brown (10YR 6/4) dry; moderate fine and medium subangular blocky structure; hard, friable; slightly sticky and plastic; common fine roots; many irregular pores; 50 percent gravel and 20 percent cobbles; neutral (pH 6.6); abrupt wavy boundary.

R—31 inches; fractured, metamorphosed volcanic bedrock.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 70 percent rock fragments and 18 to 30 percent clay.

The A horizon has value of 3 or 4 moist, 4 to 6 dry, and chroma of 2 to 4 moist and dry. The Bw horizon has hue of 10YR or 7.5YR; value of 4 or 5 moist, 5 or 6 dry; and chroma of 3 or 4 moist and dry. It is very gravelly loam, very gravelly clay loam, or extremely gravelly loam.

Carney Series

The Carney series consists of moderately deep, moderately well drained soils on alluvial fans and hillslopes. These soils formed in alluvium and colluvium derived from igneous rock. Slopes are 1 to 35 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Carney clay, 1 to 5 percent slopes, about 10 miles north of Medford; about 300 feet south and 1,320 feet east of the northwest corner of sec. 5, T. 36 S., R. 1 W.

A1—0 to 1½ inches; dark brown (10YR 3/3) clay, dark grayish brown (10YR 4/2) dry; strong fine granular structure; very hard, very firm, very sticky and very plastic; many fine roots; many fine irregular pores; neutral (pH 7.2); clear smooth boundary.

A2—1½ to 6 inches; dark brown (10YR 3/3) clay, dark grayish brown (10YR 4/2) dry; strong fine and medium subangular blocky structure; very hard, very firm, very sticky and very plastic; many fine roots; many fine irregular pores; neutral (pH 7.2); clear smooth boundary.

AB—6 to 12 inches; dark brown (10YR 3/3) clay, dark grayish brown (10YR 4/2) dry; moderate coarse

prismatic structure parting to strong coarse and medium angular blocky; appears massive when wet; extremely hard, extremely firm, very sticky and very plastic; few fine roots; common very fine tubular pores; neutral (pH 7.0); clear smooth boundary.

Bw—12 to 35 inches; dark brown (10YR 3/3) clay, dark grayish brown (10YR 4/2) dry; massive with vertical cracks 6 to 18 inches apart; extremely hard, very firm, very sticky and very plastic; intersecting slickensides; few fine roots; common fine tubular pores; neutral (pH 7.0); abrupt smooth boundary.

2Crk—35 inches; weathered sandstone that is calcareous in the fractures.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 50 to 60 percent clay. In most years the soils have cracks that are open to the surface or to the base of the plow layer. The cracks are at least 1 centimeter wide at a depth of 20 inches. The soils have intersecting slickensides.

The A horizon has value of 2 or 3 moist, 3 or 4 dry, and chroma of 1.5 to 3 moist and dry. It is clay or cobbly clay. The AB and Bw horizons have hue of 7.5YR and 10YR; value of 2 to 4 moist, 3 or 4 dry; and chroma of 2 or 3 moist, 1 to 4 dry. In some pedons the Bw horizon is calcareous.

Central Point Series

The Central Point series consists of very deep, well drained soils on stream terraces. These soils formed in alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Central Point sandy loam, 0 to 3 percent slopes, on the Southern Oregon Branch Experiment Station, about 35 feet north and 90 feet west of the southeast corner of a plot south of an irrigation sump; about 1,240 feet north and 890 feet west of the southeast corner of sec. 21, T. 37 S., R. 2 W.

Ap—0 to 6 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; weak medium granular structure; hard, friable, nonsticky and slightly plastic; many very fine roots; slightly acid (pH 6.4); clear smooth boundary.

A1—6 to 17 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; massive (compaction pan); hard, friable, nonsticky and slightly plastic; many very fine roots; common fine and very fine pores; few wormcasts; slightly acid (pH 6.2); clear smooth boundary.

A2—17 to 30 inches; very dark brown (10YR 2/2) sandy loam, dark gray (10YR 4/1) dry; weak medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many roots; many very fine and fine tubular pores; common wormholes and wormcasts; slightly acid (pH 6.4); clear wavy boundary.

Bw1—30 to 42 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak medium prismatic structure parting to weak medium subangular blocky; very hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine and fine tubular pores; common wormholes and wormcasts; krotovina of material from the A horizon at a depth of 34 inches; neutral (pH 6.6); gradual wavy boundary.

Bw2—42 to 49 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; common fine distinct yellowish red mottles; weak medium prismatic structure parting to weak coarse subangular blocky; very hard, friable, sticky and plastic; few fine roots; many fine tubular pores; neutral (pH 6.6); clear wavy boundary.

C1—49 to 59 inches; dark brown (10YR 3/3) gravelly sandy loam, brown (10YR 5/3) dry; common fine distinct yellowish red mottles; massive; very hard, friable, sticky and plastic; few fine roots; many fine tubular pores; 25 percent angular fragments of quartz 2 to 4 millimeters in diameter; neutral (pH 6.6); abrupt wavy boundary.

2C2—59 to 67 inches; dark brown (10YR 3/3) gravelly loamy sand, brown (10YR 4/3) dry; massive; loose, nonsticky and nonplastic; few roots; many tubular pores; 30 percent angular and rounded gravel; neutral (pH 6.7).

The depth to bedrock is 60 inches or more. The particle-size control section contains 12 to 18 percent clay. The mollic epipedon is 20 to 50 inches thick.

The A horizon has value of 2 or 3 moist, 4 or 5 dry, and chroma of 1 to 3 moist and dry. The Bw horizon has value of 4 or 5 dry and chroma of 2 or 3 moist and dry. The C and 2C horizons, if they occur, are gravelly sandy loam or gravelly loamy sand and in some pedons are stratified.

Clawson Series

The Clawson series consists of very deep, poorly drained soils on alluvial fans. These soils formed in alluvium derived from granitic rock. Slopes are 2 to 5 percent. The mean annual precipitation is about 35 inches, and the mean annual temperature is about 52 degrees F.

Typical pedon of Clawson sandy loam, 2 to 5 percent slopes, about 1.5 miles northwest of Wimer; about 500

feet east and 1,000 feet north of the southwest corner of sec. 3, T. 35 S., R. 4 W.

A1—0 to 5 inches; very dark grayish brown (2.5Y 3/2) sandy loam, light brownish gray (2.5Y 6/2) dry; strong fine and medium granular structure; slightly hard, very friable, slightly sticky and nonplastic; common very fine and fine roots; many irregular pores; 5 percent gravel; moderately acid (pH 5.6); clear wavy boundary.

A2—5 to 10 inches; very dark grayish brown (2.5Y 3/2) sandy loam, light brownish gray (2.5Y 6/2) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine roots; many very fine tubular pores; moderately acid (pH 5.6); abrupt smooth boundary.

Bw—10 to 20 inches; dark grayish brown (2.5Y 4/2) sandy loam, light brownish gray (2.5Y 6/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine roots; many very fine tubular pores; 5 percent gravel; slightly acid (pH 6.1); gradual wavy boundary.

BC—20 to 45 inches; dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) sandy loam, light yellowish brown (2.5Y 6/4) dry; many large distinct and prominent dark brown (7.5YR 3/4, 4/4) and strong brown (7.5YR 4/6) mottles; weak medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; 5 percent gravel; slightly acid (pH 6.4); gradual wavy boundary.

C—45 to 60 inches; dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) sandy loam, light yellowish brown (2.5Y 6/4) dry; many large distinct and prominent dark brown (7.5YR 3/4, 4/4) and strong brown (7.5YR 4/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; 5 percent gravel; slightly acid (pH 6.4).

The depth to bedrock is 60 inches or more. The particle-size control section contains 8 to 18 percent clay.

The A horizon has hue of 10YR or 2.5Y; value of 2 to 4 moist, 5 or 6 dry; and chroma of 2 or less moist and dry. The Bw horizon has hue of 10YR or 2.5Y; value of 4 or 5 moist, 6 or 7 dry; and chroma of 2 or less moist, 2 to 4 dry. It has distinct or prominent mottles. The C horizon has hue of 10YR or 2.5Y; value of 4 to 6 moist, 6 to 8 dry; and chroma of 2 to 4 moist and dry. It has faint to prominent mottles. It is sandy loam or coarse sandy loam to a depth of 40 inches. Below this depth, it is stratified with lenses of loamy coarse sand or loam in some pedons.

Coker Series

The Coker series consists of very deep, somewhat poorly drained soils on alluvial fans. These soils formed in clayey alluvium derived from igneous rock. Slopes are 0 to 12 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Coker clay, 0 to 3 percent slopes, about 1.5 miles west of Agate Reservoir; about 1,390 feet south and 2,050 feet east of the northwest corner of sec. 27, T. 36 S., R. 1 W.

Ap—0 to 4 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; strong fine and very fine granular structure; extremely hard, extremely firm, very sticky and very plastic; many fine and very fine roots; many irregular pores; neutral (pH 7.0); abrupt smooth boundary.

A1—4 to 10 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; weak medium and coarse angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few pressure faces; many very fine and fine roots; common very fine tubular pores; neutral (pH 7.2); clear smooth boundary.

A2—10 to 20 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate coarse and medium prismatic structure; extremely hard, extremely firm, very sticky and very plastic; common slickensides; common fine and very fine roots; common very fine tubular pores; neutral (pH 7.2); gradual smooth boundary.

Ak—20 to 33 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate coarse and medium prismatic structure; extremely hard, extremely firm, very sticky and very plastic; common slickensides; common fine roots; common very fine tubular pores; slightly effervescent; few fine segregated soft masses of lime; mildly alkaline (pH 7.8); clear wavy boundary.

ABk—33 to 46 inches; dark grayish brown (10YR 4/2) clay, grayish brown (10YR 5/2) dry; common tongues of material that is very dark gray (10YR 3/1) and dark gray (10YR 4/1) dry; weak coarse prismatic structure; extremely hard, extremely firm, very sticky and very plastic; many intersecting slickensides; common fine roots; few very fine tubular pores; strongly effervescent; few fine segregated soft masses of lime; moderately alkaline (pH 8.0); gradual wavy boundary.

Bk1—46 to 59 inches; dark grayish brown (10YR 4/2) clay, grayish brown (10YR 5/2) dry; massive; extremely hard, extremely firm, very sticky and very plastic; many intersecting slickensides; common fine roots; few very fine tubular pores; strongly effervescent; common fine segregated soft masses of lime; moderately alkaline (pH 8.4); gradual wavy boundary.

Bk2—59 to 70 inches; dark grayish brown (10YR 4/2) clay, grayish brown (10YR 5/2) dry; massive, extremely hard, extremely firm, very sticky and very plastic; few fine roots; few very fine tubular pores; strongly effervescent; common medium segregated soft masses of lime; moderately alkaline (pH 8.4).

The depth to bedrock is 60 inches or more. The particle-size control section contains 60 to 70 percent clay. In most years the soils have cracks that are open to the surface or to the base of a plow layer. These cracks are at least 1 centimeter wide at a depth of 20 inches. The soils have intersecting slickensides.

The A horizon has hue of 10YR or 2.5Y; value of 2 or 3 moist, 3 to 5 dry; and chroma of 1.5 or less moist and dry. The ABk and Bk horizons have hue of 10YR or 2.5Y, value of 4 or 5 moist and dry, and chroma of 2 to 4 moist and dry.

Coleman Series

The Coleman series consists of very deep, moderately well drained soils on stream terraces. These soils formed in alluvium derived from sedimentary rock. Slopes are 0 to 7 percent. The mean annual precipitation is about 22 inches, and the mean annual temperature is about 52 degrees F.

Typical pedon of Coleman loam, 0 to 7 percent slopes, about 1,100 feet south of Dark Hollow Road and 325 feet west of Colver Road; about 840 feet west and 540 feet south of the northeast corner of sec. 21, T. 38 S., R. 1 W.

Ap—0 to 8 inches; dark brown (10YR 3/3) loam, yellowish brown (10YR 5/4) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many roots; many very fine irregular pores; moderately acid (pH 5.8); abrupt smooth boundary.

BA—8 to 20 inches; dark brown (7.5YR 3/3) clay loam, dark yellowish brown (10YR 4/4) dry; weak coarse prismatic structure parting to weak coarse to fine subangular blocky; slightly hard, friable, sticky and plastic; many roots; common very fine tubular pores; slightly acid (pH 6.4); abrupt smooth boundary.

2Bt1—20 to 31 inches; dark brown (7.5YR 4/4) clay, dark brown (7.5YR 4/4) dry; common medium distinct strong brown (7.5YR 5/6) mottles; strong medium prismatic structure; very hard, very firm, very sticky and very plastic; few fine roots; few very fine and fine tubular pores; common distinct and faint clay films on faces of peds; slightly acid (pH 6.4); abrupt smooth boundary.

2Bt2—31 to 40 inches; dark brown (7.5YR 4/4) clay, dark brown (7.5YR 4/4) dry; few medium distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; very hard, very firm, very sticky and very plastic; few fine roots; common very fine pores; few distinct clay films on faces of peds and in pores; 5 percent gravel; neutral (pH 6.6); clear wavy boundary.

2C1—40 to 58 inches; dark brown (7.5YR 4/4) clay loam, yellowish red (5YR 4/8) dry; massive; hard, firm, sticky and plastic; many very fine pores; 10 percent gravel; neutral (pH 6.8); abrupt smooth boundary.

2C2—58 to 65 inches; yellowish red (5YR 4/6) clay loam, strong brown (7.5YR 5/8) dry; massive; hard, firm, sticky and plastic; neutral (pH 7.0).

The depth to bedrock is 60 inches or more. The A horizon has hue of 10YR, 7.5YR, or 5YR; value of 3 moist, 4 or 5 dry; and chroma of 2 or 3 moist, 3 or 4 dry. The Bt horizon has hue of 7.5YR or 5YR; value of 4 moist, 4 or 5 dry; and chroma of 3 or 4 moist and dry. It is clay or gravelly clay and contains 45 to 55 percent clay and 0 to 35 percent rock fragments. The 2C horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 moist, 4 to 6 dry; and chroma of 3 to 8 moist and dry. It is clay loam, gravelly clay loam, or very gravelly clay loam and contains 5 to 60 percent rock fragments.

Colestine Series

The Colestine series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from altered sedimentary and volcanic rock. Slopes are 50 to 80 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Colestine gravelly loam, in an area of Beekman-Colestine gravelly loams, 50 to 80 percent north slopes, about 5.5 miles northwest of Gold Hill; about 1,885 feet west and 1,760 feet north of the southeast corner of sec. 18, T. 35 S., R. 3 W.

Oi—1 inch to 0; needles, leaves, and twigs.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) gravelly loam, brown (10YR 4/3) dry; weak fine granular structure; soft, friable, slightly sticky and

slightly plastic; many fine and medium roots; many fine irregular pores; 20 percent gravel; neutral (pH 6.6); clear smooth boundary.

AB—5 to 9 inches; dark brown (10YR 3/3) gravelly loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; common very fine tubular pores; 15 percent gravel; neutral (pH 6.6); gradual smooth boundary.

Bw1—9 to 19 inches; dark yellowish brown (10YR 4/4) gravelly loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common medium and few large roots; many very fine tubular pores; 25 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

Bw2—19 to 34 inches; brown (7.5YR 4/4) gravelly loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common medium and few large roots; many fine and very fine tubular pores; 20 percent gravel and 10 percent cobbles; neutral (pH 6.6); clear smooth boundary.

R—34 inches; highly fractured, metamorphosed bedrock.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 22 to 30 percent clay and 15 to 35 percent rock fragments.

The A horizon has value of 3 or 4 moist, 4 to 6 dry, and chroma of 2 to 4 moist, 3 or 4 dry. The Bw horizon has hue of 2.5Y, 10YR, or 7.5YR; value of 4 or 5 moist, 5 to 7 dry; and chroma of 3 to 6 moist and dry. It is gravelly loam or gravelly clay loam.

Cove Series

The Cove series consists of very deep, poorly drained soils on flood plains. These soils formed in clayey alluvium derived from igneous rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Cove clay, 0 to 3 percent slopes, about 0.5 mile north of Tou Velle State Park; about 125 feet west and 125 feet north of the southeast corner of sec. 11, T. 36 S., R. 2 W.

A—0 to 7 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate medium and fine granular structure; very hard, very firm, very sticky and very plastic; many very fine roots; many fine irregular pores; slightly acid (pH 6.5); abrupt smooth boundary.

AB—7 to 16 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; weak medium prismatic structure parting to weak medium subangular blocky; very hard, very firm, very sticky and very plastic; many very fine and fine roots; many fine irregular pores; slightly acid (pH 6.5); clear wavy boundary.

Bw1—16 to 32 inches; very dark gray (N 3/0) clay, dark gray (N 4/0) dry; common fine distinct mottles; weak coarse prismatic structure parting to moderate fine subangular blocky; very hard, very firm, very sticky and very plastic; common fine roots; many fine tubular pores; neutral (pH 6.6); gradual wavy boundary.

Bw2—32 to 50 inches; very dark gray (N 3/0) clay, dark gray (N 4/0) dry; common fine distinct mottles; weak coarse prismatic structure parting to moderate fine subangular blocky; very hard, very firm, very sticky and very plastic; common fine roots; many fine tubular pores; neutral (pH 6.8); clear wavy boundary.

C—50 to 60 inches; dark grayish brown (2.5Y 4/2) silty clay, grayish brown (2.5Y 5/2) dry; common fine distinct mottles; massive; very hard, firm, sticky and plastic; common fine roots; many fine and medium tubular pores; neutral (pH 7.2).

The soils are saturated to the surface for at least 1 month in most years. The depth to bedrock is 60 inches or more. In most years the soils have cracks that are open to the surface or to the base of a plow layer. These cracks are at least 1 centimeter wide at a depth of 20 inches. The soils do not have intersecting slickensides. The particle-size control section contains 50 to 60 percent clay.

The A horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 2 or 3 moist, 3 to 5 dry, and chroma of 0 or 1. The Bw and C horizons have hue of 2.5Y, 5Y, or 10YR or are neutral in hue. They have value of 2 to 4 moist, 4 or 5 dry, and chroma of 0 to 2 moist and dry. They are clay or silty clay.

Coyata Series

The Coyata series consists of moderately deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium and residuum derived from igneous rock. Slopes are 0 to 80 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Coyata gravelly loam, in an area of Dumont-Coyata gravelly loams, 12 to 35 percent north slopes, about 3 miles west of Medco Pond; about 200 feet north and 750 feet east of the southwest corner of sec. 32, T. 33 S., R. 3 E.

Oi—1½ inches to 0; needles, leaves and twigs.

A—0 to 11 inches; dark reddish brown (5YR 3/2) gravelly loam, brown (7.5YR 4/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many fine irregular pores; 20 percent gravel and 10 percent cobbles; moderately acid (pH 6.4); clear wavy boundary.

BA—11 to 21 inches; dark brown (7.5YR 3/4) very cobbly clay loam, dark brown (7.5YR 4/4) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many very fine, fine, and medium and common coarse roots; many very fine irregular pores; 20 percent gravel, 15 percent cobbles, and 10 percent stones; moderately acid (pH 5.8); clear wavy boundary.

Bw—21 to 31 inches; dark brown (7.5YR 4/4) extremely cobbly clay loam, strong brown (7.5YR 4/6) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and common very fine and medium roots; few fine tubular pores; 35 percent gravel, 20 percent cobbles, and 10 percent stones; strongly acid (pH 5.2); abrupt wavy boundary.

R—31 inches; fractured andesite.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 70 percent rock fragments and 25 to 35 percent clay. The umbric epipedon is 10 to 20 inches thick.

The A horizon has hue of 5YR or 7.5YR; value of 2 or 3 moist, 4 or 5 dry; and chroma of 2 or 3 moist and dry. It is gravelly loam or very stony loam. The Bw horizon has hue of 5YR or 7.5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 3 to 6 moist and dry. It is very cobbly clay loam, extremely cobbly clay loam, or very cobbly loam.

Crater Lake Series

The Crater Lake series consists of very deep, well drained soils on plateaus and hillslopes. These soils formed in volcanic ash and pumice. Slopes are 1 to 70 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Crater Lake sandy loam, in an area of Crater Lake-Alcot complex, 1 to 12 percent slopes, about 1 mile northwest of Prospect; about 400 feet west and 1,350 feet south of the northeast corner of sec. 31, T. 32 S., R. 3 E.

Oi—3 inches to 0; needles and twigs.

A—0 to 5 inches; dark yellowish brown (10YR 3/4) sandy loam, brown (10YR 4/3) dry; weak very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and common medium and coarse roots; common fine and very fine pores; 5 percent gravel and 5 percent cobbles; slightly acid (pH 6.4); clear smooth boundary.

Bw—5 to 22 inches; dark yellowish brown (10YR 4/4) sandy loam, light yellowish brown (10YR 6/4) dry; weak very fine and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; common fine and very fine pores; 5 percent gravel and 5 percent cobbles; slightly acid (pH 6.4); gradual wavy boundary.

C1—22 to 50 inches; strong brown (7.5YR 5/6) sandy loam, pink (7.5YR 7/4) dry; massive; slightly hard, friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; many very fine and fine tubular pores; 5 percent gravel and 5 percent cobbles; moderately acid (pH 5.6); gradual wavy boundary.

C2—50 to 60 inches; brown (7.5YR 5/4) sandy loam, pink (7.5YR 7/4) dry; massive; slightly hard, friable, nonsticky and nonplastic; few very fine, fine, and medium roots; many tubular pores; 5 percent gravel; moderately acid (pH 5.6).

The depth to bedrock is 60 inches or more. The particle-size control section contains 60 or more percent volcanic ash and pumice. It has a bulk density of 0.75 to 0.90 gram per cubic centimeter.

The A horizon has hue of 10YR or 7.5YR; value of 2 to 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist and dry. The Bw horizon has hue of 10YR or 7.5YR; value of 3 to 5 moist, 5 to 7 dry; and chroma of 4 to 6 moist, 3 or 4 dry. It is sandy loam, fine sandy loam, or very fine sandy loam. The C horizon has hue of 10YR, 7.5YR, or 2.5Y; value of 4 to 6 moist, 6 to 8 dry; and chroma of 3 to 6 moist, 2 to 4 dry. It is sandy loam, fine sandy loam, or gravelly sandy loam and contains 0 to 25 percent rock fragments.

Darow Series

The Darow series consists of moderately deep, moderately well drained soils on hillslopes. These soils formed in colluvium derived from sedimentary rock. Slopes are 1 to 35 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Darow silty clay loam, 20 to 35 percent slopes, about 4 miles south of Medford; about 1,750 feet west and 850 feet south of the northeast corner of sec. 13, T. 38 S., R. 2 W.

A1—0 to 5 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; strong medium granular structure; hard, friable, slightly sticky and plastic; many fine roots; many irregular pores; neutral (pH 6.8); abrupt smooth boundary.

A2—5 to 12 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; common fine and few medium roots; many very fine tubular pores; neutral (pH 6.6); clear smooth boundary.

BA—12 to 21 inches; dark brown (10YR 4/3) silty clay, yellowish brown (10YR 5/4) dry; weak coarse subangular blocky structure; very hard, firm, very sticky and plastic; few fine and medium roots; common very fine tubular pores; slightly acid (pH 6.4); clear smooth boundary.

Bt—21 to 32 inches; dark yellowish brown (10YR 4/4) silty clay, yellowish brown (10YR 5/4) dry; weak coarse prismatic structure; very hard, very firm, very sticky and very plastic; common fine roots; common very fine tubular pores; few distinct clay films on faces of peds and in pores; slightly acid (pH 6.4); clear wavy boundary.

Crt—32 inches; weathered siltstone; prominent dark brown (7.5YR 4/4) clay films in fractures.

The depth to bedrock is 20 to 40 inches (fig. 16). The particle-size control section contains 45 to 60 percent clay. In most years the soils have cracks that are open to the surface or to the base of a plow layer. These cracks are at least 1 centimeter wide at a depth of 20 inches. The soils do not have intersecting slickensides.

The A horizon has hue of 10YR or 7.5YR and chroma of 2 or 3 moist, 3 or 4 dry. The Bt horizon has hue of 10YR, 7.5YR, or 2.5Y; value of 4 or 5 moist, 5 or 6 dry; and chroma of 3 or 4 moist and dry. It is silty clay or clay.

Figure 16.—Profile of a Darow silty clay loam. Siltstone is at a depth of about 2 feet.

Debenger Series

The Debenger series consists of moderately deep, well drained soils on knolls and ridges. These soils formed in colluvium derived from sandstone. Slopes are 1 to 40 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Debenger loam, in an area of Debenger-Brader loams, 1 to 15 percent slopes, about 6 miles north of Tou Velle State Park; about 2,400 feet west and 1,600 feet south of the northeast corner of sec. 14, T. 35 S., R. 2 W.

A1—0 to 5 inches; dark brown (7.5YR 3/4) loam, brown (7.5YR 5/4) dry; moderate medium platy structure; friable, slightly sticky and slightly plastic; many very fine and fine roots; many irregular pores; slightly acid (pH 6.2); clear smooth boundary.

A2—5 to 9 inches; reddish brown (5YR 4/4) loam, reddish brown (5YR 5/4) dry; moderate thick platy and moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; many fine roots; many fine irregular pores; slightly acid (pH 6.2); clear smooth boundary.

Bw1—9 to 18 inches; reddish brown (5YR 4/4) clay loam, yellowish red (5YR 4/6) dry; moderate medium subangular blocky structure; firm, sticky and plastic; few fine roots; common very fine tubular pores; moderately acid (pH 6.0); clear smooth boundary.

Bw2—18 to 27 inches; yellowish red (5YR 4/6) clay

loam, yellowish red (5YR 4/6) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common very fine tubular pores; moderately acid (pH 5.9); abrupt smooth boundary.

2Cr—27 inches; partially decomposed sandstone.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 20 to 35 percent clay.

The A horizon has hue of 5YR, 7.5YR, or 10YR; value of 3 or 4 moist, 5 or 6 dry; and chroma of 2 to 4 moist and dry. The Bw horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 to 6 dry; and chroma of 3 to 6 moist and dry. It is clay loam or loam.

Donegan Series

The Donegan series consists of moderately deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium derived from igneous rock and volcanic ash. Slopes are 3 to 65 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Donegan gravelly loam, in an area of Donegan-Killet gravelly loams, 12 to 35 percent south slopes; about 200 feet north and 600 feet east of the southwest corner of sec. 35, T. 33 S., R. 2 E.

Oi—3 inches to 0; leaves, needles, and twigs.

A—0 to 10 inches; dark brown (7.5YR 3/2) gravelly loam, brown (7.5YR 4/2) dry; strong fine and medium granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine irregular pores; 25 percent gravel and 5 percent cobbles; slightly acid (pH 6.4); abrupt smooth boundary.

BA—10 to 22 inches; dark brown (7.5YR 3/2) gravelly loam, brown (7.5YR 4/2) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; common very fine and fine tubular pores; 25 percent gravel and 9 percent cobbles; slightly acid (pH 6.4); clear wavy boundary.

Bw—22 to 32 inches; dark brown (7.5YR 3/2) extremely gravelly loam, brown (7.5YR 4/2) dry; moderate very fine and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; common very fine and fine tubular pores; 45 percent gravel and 20 percent cobbles; slightly acid (pH 6.2); abrupt irregular boundary.

Cr—32 inches; weathered basalt.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 75 percent rock fragments and 20 to 35 percent clay. The umbric epipedon is 20 to 40 inches thick.

The A horizon has hue of 5YR or 7.5YR; value of 2 or 3 moist, 3 to 5 dry; and chroma of 2 or 3 moist and dry. The Bw horizon has hue of 5YR or 7.5YR; value of 3 or 4 moist, 4 or 5 dry; and chroma of 2 or 3 moist, 3 or 4 dry. It is very cobbly loam, extremely gravelly loam, extremely gravelly clay loam, or very gravelly clay loam.

Dubakella Series

The Dubakella series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from serpentinitic rock. Slopes are 12 to 70 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Dubakella very stony clay loam, rocky, 35 to 70 percent slopes, about 5.5 miles northeast of Wimer; about 250 feet south and 1,500 feet west of the northeast corner of sec. 18, T. 34 S., R. 2 W.

A1—0 to 3 inches; dark reddish brown (5YR 3/4) very stony clay loam, reddish brown (5YR 4/4) dry; moderate very fine and fine granular structure; soft, friable, slightly sticky and plastic; many very fine and fine roots; many very fine and fine irregular pores; stones covering 10 percent of the surface; slightly acid (pH 6.4); abrupt smooth boundary.

A2—3 to 11 inches; dark reddish brown (2.5YR 3/4) very stony clay loam, reddish brown (5YR 4/4) dry; weak very fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and medium roots; many very fine and fine pores; 15 percent gravel, 15 percent cobbles, and 15 percent stones; slightly acid (pH 6.4); clear wavy boundary.

Bt1—11 to 19 inches; dark reddish brown (2.5YR 3/4) very cobbly clay, reddish brown (2.5YR 4/4) dry; weak very fine and fine subangular blocky structure; hard, friable, sticky and plastic; common coarse and medium roots; many very fine and fine pores; common distinct clay films on faces of peds and in pores; 15 percent gravel and 35 percent cobbles; slightly acid (pH 6.4); clear wavy boundary.

Bt2—19 to 31 inches; dark reddish brown (5YR 3/4) very cobbly clay, dark reddish brown (2.5YR 3/4) dry; weak fine and medium subangular blocky structure; hard, firm, sticky and very plastic; few very fine, fine, and medium roots; many very fine and fine pores; many distinct clay films on faces of peds and in pores; 15 percent gravel and 40

percent cobbles; slightly acid (pH 6.4); abrupt irregular boundary.
R—31 inches; fractured serpentinite.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 60 percent rock fragments and 35 to 50 percent clay.

The A horizon has hue of 7.5YR, 5YR, or 2.5YR; value of 3 or 4 moist, 3 to 5 dry; and chroma of 2 to 4 moist and dry. The Bt horizon has hue of 7.5YR, 5YR, or 2.5YR; value of 3 or 4 moist, 3 to 5 dry; and chroma of 3 or 4 moist and dry. It is very gravelly clay loam, very gravelly clay, or very cobbly clay.

Dumont Series

The Dumont series consists of very deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium and residuum derived from igneous rock and altered sedimentary and volcanic rock. Slopes are 1 to 60 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Dumont gravelly loam, in an area of Dumont-Coyata gravelly loams, 12 to 35 percent north slopes, about 2 miles west of Medco Pond; about 2,400 feet north and 2,600 feet west of the southeast corner of sec. 28, T. 33 S., R. 3 E.

Oi—1 inch to 0; needles, leaves, and twigs.
A1—0 to 6 inches; dark reddish brown (5YR 3/2) gravelly loam, dark brown (7.5YR 4/4) dry; moderate fine granular structure; soft, friable, nonsticky and nonplastic; many very fine and fine irregular pores; 15 percent gravel; moderately acid (pH 6.0); abrupt smooth boundary.
A2—6 to 9 inches; dark reddish brown (5YR 3/3) gravelly loam, dark brown (7.5YR 3/4) dry; weak fine subangular blocky structure parting to moderate fine granular; soft, friable, nonsticky and nonplastic; many very fine and fine and common medium and coarse roots; many very fine and fine irregular pores; 15 percent gravel; moderately acid (pH 5.8); clear smooth boundary.
AB—9 to 18 inches; dark reddish brown (5YR 3/4) clay loam, brown (7.5YR 4/4) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and common medium and coarse roots; few fine tubular pores; 5 percent gravel; strongly acid (pH 5.4); clear smooth boundary.
Bt1—18 to 26 inches; dark reddish brown (5YR 3/4) clay, brown (7.5YR 4/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common fine tubular pores; common faint clay films on faces of peds; strongly acid (pH 5.4); clear smooth boundary.
Bt2—26 to 37 inches; dark reddish brown (5YR 3/4) clay, brown (7.5YR 4/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common fine tubular pores; common distinct clay films on faces of peds; strongly acid (pH 5.2); clear smooth boundary.
Bt3—37 to 68 inches; dark reddish brown (5YR 3/4) clay, brown (7.5YR 4/4) dry; few fine black stains; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many fine tubular pores; common distinct clay films on faces of peds; strongly acid (pH 5.2).

The depth to bedrock is 60 inches or more. The particle-size control section contains 40 to 50 percent clay.

The A horizon has hue of 5YR or 7.5YR; value of 2 or 3 moist, 3 to 5 dry; and chroma of 2 to 4 moist and dry. It is gravelly loam or gravelly clay loam. The Bt horizon has hue of 5YR or 7.5YR; value of 3 or 4 moist, 4 or 5 dry; and chroma of 3 or 4 moist, 3 to 6 dry. It is clay or silty clay.

Evans Series

The Evans series consists of very deep, well drained soils on flood plains. These soils formed in alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 52 degrees F.

Typical pedon of Evans loam, 0 to 3 percent slopes, about 2 miles south of Shady Cove; about 1,400 feet west and 300 feet north of the southeast corner of sec. 29, T. 34 S., R. 1 W.

A1—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate very fine and fine subangular blocky structure parting to moderate very fine granular; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine irregular and tubular pores; 10 percent gravel; moderately acid (pH 6.0); abrupt smooth boundary.
A2—8 to 26 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate very fine and fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine irregular and tubular pores; 10 percent gravel; slightly acid (pH 6.2); clear smooth boundary.
A3—26 to 38 inches; very dark brown (10YR 2/2) loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; slightly hard, friable,

slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine irregular and tubular pores; 5 percent gravel; slightly acid (pH 6.3); clear smooth boundary.

C—38 to 60 inches; dark brown (7.5YR 3/2) loam, yellowish brown (10YR 5/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine irregular and tubular pores; 2 percent gravel; slightly acid (pH 6.4).

The depth to bedrock is 60 inches or more. The particle-size control section contains 10 to 18 percent clay and 15 or more percent fine sand or coarser sand. The mollic epipedon is 20 to 40 inches thick. The soils are characterized by an irregular decrease in content of organic matter to a depth of 50 inches.

The A horizon has value of 2 or 3 moist, 4 or 5 dry, and chroma of 2 or 3 moist, 2 to 4 dry. The C horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 or 3 moist, 2 to 4 dry. It is loam, silt loam, or very fine sandy loam.

Farva Series

The Farva series consists of moderately deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium derived from igneous rock and volcanic ash. Slopes are 3 to 70 percent. The mean annual precipitation is about 43 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Farva very cobbly loam, 12 to 35 percent south slopes, about 0.3 mile north of Hyatt Lake; about 1,850 feet south and 700 feet east of the northwest corner of sec. 11, T. 39 S., R. 3 E.

Oi—½ inch to 0; needles, leaves, and twigs.

A—0 to 5 inches; dark brown (7.5YR 3/2) very cobbly loam, brown (10YR 4/3) dry; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; common medium and fine roots; many irregular pores; 20 percent gravel and 25 percent cobbles; slightly acid (pH 6.4); clear wavy boundary.

AB—5 to 12 inches; dark brown (7.5YR 3/4) very cobbly loam, brown (7.5YR 4/4) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common medium and fine roots; many irregular pores; 20 percent gravel, 25 percent cobbles, and 10 percent stones; slightly acid (pH 6.3); gradual wavy boundary.

Bw—12 to 27 inches; brown (7.5YR 4/4) extremely cobbly loam, brown (7.5YR 5/4) dry; weak medium and fine subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; few fine, medium, and coarse roots; many fine tubular pores; 25 percent gravel, 25 percent cobbles, and 15 percent stones; slightly acid (pH 6.2); gradual wavy boundary.

C—27 to 35 inches; brown (7.5YR 4/4) extremely cobbly loam, brown (7.5YR 5/4) dry; massive; soft, very friable, nonsticky and nonplastic; few medium and coarse roots; many irregular pores; 20 percent gravel, 35 percent cobbles, and 10 percent stones; moderately acid (pH 5.8); abrupt wavy boundary.

2Cr—35 inches; partially weathered andesitic bedrock.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 45 to 80 percent rock fragments and 15 to 25 percent clay.

The A and AB horizons have hue of 5YR, 7.5YR, or 10YR; value of 3 to 5 moist, 4 or 5 dry; and chroma of 2 to 4 moist and dry. The Bw and C horizons have hue of 5YR or 7.5YR; value of 3 or 4 moist, 4 or 5 dry; and chroma of 3 or 4 moist and dry. They are extremely cobbly or very cobbly loam.

Foehlin Series

The Foehlin series consists of very deep, well drained soils on stream terraces. These soils formed in alluvium derived from altered sedimentary and volcanic rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Foehlin gravelly loam, 0 to 3 percent slopes; about 660 feet west and 1,300 feet south of the northeast corner of sec. 25, T. 35 S., R. 3 W.

Ap—0 to 4 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; strong fine subangular blocky structure parting to strong fine and very fine granular; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; common fine and very fine irregular pores; 15 percent gravel; moderately acid (pH 5.6); abrupt smooth boundary.

A1—4 to 11 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; moderate coarse, medium, and fine subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine roots; common very fine tubular and irregular pores; 5 percent gravel; moderately acid (pH 5.6); abrupt smooth boundary.

A2—11 to 19 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; moderate fine and very fine subangular blocky structure; hard, friable, sticky and plastic; common

fine and very fine roots; many very fine and fine irregular and tubular pores; 5 percent gravel; moderately acid (pH 5.6); clear smooth boundary.

Bt1—19 to 34 inches; dark brown (10YR 3/3) clay loam, brown (10YR 5/3) dry; moderate medium, fine, and very fine subangular blocky structure; hard, friable, sticky and plastic; common very fine, fine, and medium roots; many very fine and fine tubular and irregular pores; common faint and distinct clay films on faces of peds and many distinct clay films in pores; 5 percent gravel; moderately acid (pH 5.7); clear smooth boundary.

Bt2—34 to 42 inches; brown (10YR 4/3) clay loam, brown (10YR 5/3) dry; weak medium, fine, and very fine subangular blocky structure; hard, friable, sticky and plastic; few very fine, fine, and medium roots; many very fine and fine tubular pores; common faint clay films on faces of peds and common faint and distinct clay films in pores; 5 percent gravel; moderately acid (pH 5.7); gradual smooth boundary.

Bt3—42 to 60 inches; dark yellowish brown (10YR 4/4) clay loam, yellowish brown (10YR 5/4) dry; common fine distinct light brownish gray (2.5Y 6/2) mottles below a depth of 55 inches; massive; slightly hard, friable, sticky and plastic; few very fine, fine, and medium roots; many very fine and fine tubular pores; common faint and distinct clay films in pores; 5 percent gravel; moderately acid (pH 5.8).

The depth to bedrock is 60 inches or more. The particle-size control section contains 27 to 35 percent clay and 5 to 30 percent rock fragments. The mollic epipedon is 10 to 20 inches thick.

The A horizon has hue of 10YR or 7.5YR; value of 2 or 3 moist, 4 or 5 dry; and chroma of 2 or 3 moist and dry. The Bt horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 5 or 6 dry; and chroma of 3 or 4 moist and dry. It is gravelly clay loam or clay loam.

Freezener Series

The Freezener series consists of very deep, well drained soils on hillslopes and plateaus. These soils formed in colluvium and residuum derived from igneous rock. Slopes are 1 to 60 percent. The mean annual precipitation is about 40 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Freezener gravelly loam, in an area of Freezener-Geppert complex, 12 to 35 percent south slopes, about 7 miles northeast of Butte Falls; about 300 feet north and 400 feet east of the southwest corner of sec. 16, T. 34 S., R. 3 E.

Oi—1½ inches to 0; needles, leaves, and twigs.

A1—0 to 3 inches; dark reddish brown (5YR 3/2) gravelly loam, dark brown (7.5YR 4/3) dry; strong very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many fine and medium irregular pores; 15 percent gravel; moderately acid (pH 6.0); abrupt smooth boundary.

A2—3 to 9 inches; dark reddish brown (5YR 3/4) gravelly loam, brown (7.5YR 5/4) dry; moderate fine granular and moderate very fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine and common fine roots; common very fine tubular and many very fine, fine, and medium irregular pores; 15 percent gravel; moderately acid (pH 5.8); clear wavy boundary.

Bt1—9 to 18 inches; dark reddish brown (5YR 3/4) clay loam, dark brown (7.5YR 4/4) dry; moderate very fine subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; common very fine tubular and common very fine and fine irregular pores; few distinct clay films on faces of peds; 5 percent gravel; moderately acid (pH 5.8); clear smooth boundary.

Bt2—18 to 28 inches; dark reddish brown (5YR 3/4) clay, dark brown (7.5YR 4/4) dry; moderate medium and fine subangular blocky structure; hard, firm, very sticky and very plastic; few fine and medium roots; common very fine tubular pores; common distinct clay films on faces of peds; 5 percent gravel; moderately acid (pH 5.6); gradual smooth boundary.

Bt3—28 to 45 inches; dark brown (7.5YR 3/4) clay, dark brown (7.5YR 4/4) dry; moderate medium angular blocky structure; hard, very firm, very sticky and very plastic; few fine and medium roots; common very fine tubular pores; many distinct clay films on faces of peds; 5 percent gravel; strongly acid (pH 5.4); gradual smooth boundary.

Bt4—45 to 60 inches; dark brown (7.5YR 3/4) clay loam, strong brown (7.5YR 4/6) dry; weak medium and coarse subangular blocky structure; hard, very firm, very sticky and very plastic; few fine and medium roots; common very fine tubular pores; many distinct and prominent clay films on faces of peds; 5 percent gravel; strongly acid (pH 5.4).

The depth to bedrock is 60 inches or more. The particle-size control section contains 35 to 50 percent clay.

The A horizon has hue of 5YR or 7.5YR; value of 3 or 4 moist, 4 or 5 dry; and chroma of 2 to 4 moist and dry. The Bt horizon has hue of 2.5YR, 5YR, or 7.5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 4 to 6 moist and dry. It is clay, silty clay, or clay loam.

Geppert Series

The Geppert series consists of moderately deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium derived from igneous rock. Slopes are 1 to 70 percent. The mean annual precipitation is about 40 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Geppert very cobbly loam, 35 to 70 percent north slopes, about 2 miles north of Butte Falls; about 1,800 feet north and 1,450 feet west of the southeast corner of sec. 35, T. 34 S., R. 2 E.

Oi—½ inch to 0; needles, leaves, and twigs.

A1—0 to 4 inches; dark reddish brown (5YR 3/3) very cobbly loam, dark brown (7.5YR 3/4) dry; weak fine subangular blocky structure parting to moderate medium granular; soft, friable, slightly sticky and slightly plastic; many fine and very fine and few medium roots; many fine irregular pores; 15 percent gravel and 25 percent cobbles; neutral (pH 6.6); clear smooth boundary.

A2—4 to 13 inches; dark reddish brown (5YR 3/4) very cobbly loam, dark brown (7.5YR 3/4) dry; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine and few medium roots; many fine irregular pores; 15 percent gravel and 30 percent cobbles; slightly acid (pH 6.4); clear wavy boundary.

Bw1—13 to 24 inches; dark reddish brown (5YR 3/4) extremely cobbly clay loam, dark reddish gray (5YR 4/2) dry; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common fine and medium and few coarse roots; many very fine tubular pores; 15 percent gravel and 50 percent cobbles; slightly acid (pH 6.4); clear wavy boundary.

Bw2—24 to 30 inches; dark reddish brown (5YR 3/4) extremely cobbly clay loam, dark reddish gray (5YR 4/2) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common very fine tubular pores; common black stains on rock fragments; 20 percent gravel and 60 percent cobbles; moderately acid (pH 6.0); clear wavy boundary.

2Cr—30 inches; partially weathered andesite.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 50 to 80 percent rock fragments and 20 to 35 percent clay.

The A horizon has hue of 5YR or 7.5YR; value of 2 to 4 moist, 3 to 5 dry; and chroma of 3 or 4 moist, 2 to 4 dry. The Bw horizon has hue of 2.5YR, 5YR, or 7.5YR; value of 3 or 4 moist, 4 or 5 dry; and chroma of 3 to 6 moist and dry. It is very cobbly clay loam, extremely cobbly clay loam, or extremely cobbly loam.

Goolaway Series

The Goolaway series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from altered volcanic rock. Slopes are 12 to 50 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Goolaway silt loam, 35 to 50 percent north slopes, about 2 miles east of Battle Mountain; about 2,340 feet east and 1,510 feet south of the northwest corner of sec. 5, T. 34 S., R. 3 W.

Oi—2 inches to 0; leaves, needles, and twigs.

A—0 to 3 inches; very dark grayish brown (2.5YR 3/2) silt loam, grayish brown (2.5YR 5/2) dry; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine irregular pores; moderately acid (pH 5.7); abrupt wavy boundary.

BA—3 to 11 inches; dark grayish brown (2.5YR 4/2) silt loam, light brownish gray (2.5YR 6/2) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and common medium and coarse roots; few very fine tubular pores; 5 percent soft gravel; moderately acid (pH 5.7); clear irregular boundary.

Bt1—11 to 25 inches; olive gray (5Y 4/2) silt loam, light olive gray (5Y 6/2) dry; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium and coarse roots; common very fine and fine tubular pores; few faint clay films on faces of peds and in pores; 5 percent soft gravel; moderately acid (pH 5.7); clear irregular boundary.

Bt2—25 to 29 inches; olive (5Y 4/3) silt loam, pale olive (5Y 6/3) dry; moderate medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; few distinct clay films on faces of peds and in pores; 10 percent soft gravel; moderately acid (pH 5.8); clear wavy boundary.

Cr—29 inches; highly decomposed schist.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 18 to 27 percent clay and less than 15 percent fine sand or coarser sand.

The A horizon has hue of 10YR, 2.5Y, or 5Y; value

of 3 or 4 moist, 4 to 6 dry; and chroma of 2 or 3 moist and dry. The Bw horizon has hue of 2.5Y or 5Y; value of 4 or 5 moist, 5 or 6 dry; and chroma of 2 or 3 moist, 2 to 4 dry.

Gravecreek Series

The Gravecreek series consists of moderately deep, well drained soils on ridges and hillslopes. These soils formed in colluvium derived from serpentinitic rock. Slopes are 12 to 80 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Gravecreek gravelly loam, 35 to 55 percent north slopes; about 1,700 feet west and 2,300 feet north of the southeast corner of sec. 33, T. 33 S., R. 4 W.

Oi—1 inch to 0; needles, leaves, and twigs.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) gravelly loam, brown (10YR 5/3) dry; strong fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and common fine and medium roots; many very fine irregular pores; 25 percent gravel and 5 percent cobbles; moderately acid (pH 5.8); abrupt smooth boundary.

A2—3 to 7 inches; dark brown (10YR 3/3) gravelly loam, light yellowish brown (10YR 6/4) dry; strong fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, common fine and medium, and few coarse roots; many very fine irregular pores; 25 percent gravel and 5 percent cobbles; strongly acid (pH 5.4); clear wavy boundary.

Bw1—7 to 15 inches; brown (10YR 4/3) very gravelly clay loam, light yellowish brown (10YR 6/4) dry; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and few fine, medium, and coarse roots; common very fine tubular pores; 30 percent gravel and 15 percent cobbles; strongly acid (pH 5.4); clear wavy boundary.

Bw2—15 to 29 inches; light olive brown (2.5Y 5/4) very cobbly clay loam, very pale brown (10YR 7/4) dry; moderate fine and medium angular blocky structure; hard, friable, sticky and plastic; common very fine and few fine and medium roots; common very fine tubular pores; 30 percent gravel and 20 percent cobbles; strongly acid (pH 5.2); abrupt wavy boundary.

R—29 inches; fractured serpentinite.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 60 percent rock fragments and 27 to 35 percent clay.

The A horizon has hue of 10YR or 7.5YR; value of 2 to 4 moist, 4 to 6 dry; and chroma of 1 to 4 moist, 2 to 4 dry. It is gravelly or cobbly loam. The Bw horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 3 to 5 moist, 5 to 7 dry; and chroma of 3 or 4 moist and dry. It is very cobbly or very gravelly clay loam.

Gregory Series

The Gregory series consists of deep, poorly drained soils on stream terraces. These soils formed in alluvium derived from altered sedimentary and volcanic rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Gregory silty clay loam, 0 to 3 percent slopes, about 1 mile northwest of Lower Table Rock; about 2,200 feet west and 440 feet south of the northeast corner of sec. 6, T. 36 S., R. 2 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine roots; common fine irregular pores; slightly acid (pH 6.2); abrupt smooth boundary.

A—7 to 12 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; many very fine irregular pores; slightly acid (pH 6.2); clear smooth boundary.

BA—12 to 18 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; common fine tubular pores; slightly acid (pH 6.1); clear smooth boundary.

Bt1—18 to 29 inches; very dark grayish brown (10YR 3/2) clay, grayish brown (10YR 5/2) dry; common distinct mottles; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; few very fine tubular pores; common faint clay films; moderately acid (pH 6.0); gradual wavy boundary.

Bt2—29 to 44 inches; dark grayish brown (2.5Y 4/2) clay, grayish brown (2.5Y 5/2) dry; many distinct yellowish red (5YR 4/6) mottles; strong coarse angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine tubular pores; common distinct clay films; moderately acid (pH 5.8); gradual wavy boundary.

2C—44 to 50 inches; dark grayish brown (2.5Y 4/3) sandy clay loam, light brownish gray (2.5Y 6/3) dry;

many distinct yellowish red (5YR 4/6) mottles; massive; very hard, very firm, sticky and plastic; few very fine pores; moderately acid (pH 5.8); gradual wavy boundary.

3Cr—50 inches; weathered sandstone.

The soils are saturated to the surface for at least 1 month in most years. The depth to bedrock is 40 to 60 inches. The particle-size control section contains 35 to 45 percent clay. The mollic epipedon is 20 to 35 inches thick.

The A horizon has hue of 10YR or 2.5Y; value of 2 or 3 moist, 3 to 5 dry; and chroma of 2 or 3 moist and dry. The Bt horizon has hue of 10YR or 2.5Y; value of 3 or 4 moist, 4 or 5 dry; and chroma of 2 or 3 moist and dry. It is clay or clay loam. The 2C horizon has value of 4 or 5 moist, 5 or 6 dry, and chroma of 3 or 4 moist and dry. It is sandy clay loam or clay loam.

Greystoke Series

The Greystoke series consists of deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium and residuum derived from igneous rock. Slopes are 1 to 75 percent. The mean annual precipitation is about 25 inches, and the mean annual temperature is about 44 degrees F.

Typical pedon of Greystoke stony loam, in an area of Greystoke-Pinehurst complex, 12 to 35 percent north slopes; about 600 feet north and 1,300 feet east of the southwest corner of sec. 32, T. 39 S., R. 7 E.

Oi—2 inches to 0; needles and twigs.

A1—0 to 3 inches; dark reddish brown (5YR 2.5/2) stony loam, brown (7.5YR 4/3) dry; moderate very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and common fine, medium, and coarse roots; many very fine irregular pores; 5 percent gravel and 25 percent cobbles and stones; moderately acid (pH 5.8); abrupt smooth boundary.

A2—3 to 13 inches; dark reddish brown (5YR 3/2) very cobbly loam, brown (7.5YR 4/3) dry; moderate very fine and fine subangular blocky structure parting to moderate fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine and common fine, medium, and coarse roots; many very fine irregular pores; 15 percent gravel and 30 percent cobbles and stones; moderately acid (pH 5.6); abrupt wavy boundary.

BA—13 to 23 inches; dark reddish brown (5YR 3/3) very cobbly loam, brown (7.5YR 4/4) dry; moderate very fine and fine angular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and few fine, medium, and coarse roots; common very fine tubular pores; 20 percent gravel and 30 percent cobbles and stones; moderately acid (pH 5.6); clear wavy boundary.

Bt—23 to 42 inches; dark reddish brown (5YR 3/3) extremely gravelly clay loam, brown (7.5YR 4/4) dry; moderate very fine and fine angular blocky structure; hard, firm, sticky and plastic; few very fine, fine, and medium roots; common very fine tubular pores; few faint clay films on faces of peds and in pores; 50 percent gravel and 20 percent cobbles; moderately acid (pH 5.6); clear wavy boundary.

Cr—42 inches; weathered andesite.

The depth to bedrock is 40 to 60 inches. The particle-size control section contains 35 to 75 percent rock fragments and 27 to 35 percent clay. The mollic epipedon is 20 to 30 inches thick.

The A horizon has hue of 7.5YR, 5YR, or 2.5YR; value of 2 or 3 moist; and chroma of 2 or 3 moist, 3 or 4 dry. The BA horizon has hue of 7.5YR, 5YR, or 2.5YR and chroma of 2 to 4 moist, 3 or 4 dry. It is very cobbly loam, very gravelly loam, or cobbly clay loam. The Bt horizon has hue of 7.5YR, 5YR, or 2.5YR and chroma of 3 or 4 moist and dry. It is very cobbly, very gravelly, or extremely gravelly clay loam.

Heppsie Series

The Heppsie series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from igneous rock. Slopes are 35 to 70 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Heppsie clay, 35 to 70 percent north slopes, about 0.25 mile east of the Emigrant Reservoir; about 2,800 feet east and 100 feet south of the northwest corner of sec. 28, T. 39 S., R. 2 E.

A1—0 to 7 inches; very dark brown (10YR 2/2) clay, dark grayish brown (10YR 4/2) dry; strong fine granular structure; hard, friable, very sticky and very plastic; many fine and very fine roots; common fine irregular pores; 5 percent gravel and 5 percent cobbles; neutral (pH 6.8); clear smooth boundary.

A2—7 to 15 inches; very dark grayish brown (10YR 3/2) clay, dark grayish brown (10YR 4/2) dry; moderate fine and very fine subangular blocky structure; hard, firm, very sticky and very plastic; common fine and medium and few large roots; common fine tubular pores; 10 percent gravel; neutral (pH 6.8); clear smooth boundary.

Bw—15 to 24 inches; dark brown (7.5YR 3/4) gravelly clay, dark grayish brown (10YR 4/2) dry; weak

medium subangular blocky structure; very hard, firm, very sticky and very plastic; common fine and medium and few large roots; common fine and very fine irregular pores; 20 percent gravel and 5 percent cobbles; slightly acid (pH 6.4); clear smooth boundary.

Cr—24 inches; saprolitic tuff.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 40 to 55 percent clay and 15 to 35 percent rock fragments. In most years the soils have cracks that are open to the surface or to the base of the plow layer. These cracks are at least 1 centimeter wide at a depth of 20 inches. The soils do not have intersecting slickensides.

The A horizon has hue of 10YR or 7.5YR; value of 2 or 3 moist, 3 or 4 dry; and chroma of 2 or 3 moist and dry. The Bw horizon has hue of 10YR or 7.5YR, value of 3 or 4 dry, and chroma of 2 to 4 moist and dry.

Hobit Series

The Hobit series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from igneous rock. Slopes are 12 to 60 percent. The mean annual precipitation is about 40 inches, and the mean annual temperature is about 42 degrees F.

Typical pedon of Hobit loam, 12 to 35 percent north slopes, about 1 mile north of Soda Mountain; about 1,910 feet south and 1,350 feet east of the northwest corner of sec. 21, T. 40 S., R. 3 E.

Oi—1 inch to 0; needles and twigs.

A1—0 to 4 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; 10 percent gravel; slightly acid (pH 6.5); clear smooth boundary.

A2—4 to 18 inches; very dark brown (10YR 2/2) loam, dark brown (10YR 3/3) dry; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; common fine and very fine and few medium roots; many very fine irregular pores; 10 percent gravel; slightly acid (pH 6.4); gradual wavy boundary.

Bw—18 to 26 inches; very dark brown (10YR 2/2) loam, brown (10YR 4/3) dry; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; many very fine irregular pores; 10 percent gravel; slightly acid (pH 6.2); clear irregular boundary.

C—26 to 35 inches; dark yellowish brown (10YR 4/6) gravelly clay loam, yellowish brown (10YR 5/6) dry; massive; slightly hard, friable, sticky and plastic; weakly smeary; few roots; many very fine irregular pores; 15 percent hard gravel and 10 percent soft gravel; moderately acid (pH 5.8); clear irregular boundary.

Cr—35 inches; highly weathered volcanic tuff and breccia.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 18 to 30 percent clay and 5 to 30 percent rock fragments. It has a bulk density of 0.50 to 0.85 gram per cubic centimeter.

The A horizon has value of 2 or 3 moist, 3 or 4 dry, and chroma of 2 or 3 moist and dry. The Bw horizon has value of 2 or 3 moist, 3 to 5 dry, and chroma of 2 or 3 moist and dry. It is loam, clay loam, or gravelly clay loam. The C horizon, if it occurs, has hue of 7.5YR, 10YR, or 2.5Y; value of 4 or 5 moist, 4 to 7 dry; and chroma of 4 to 6 moist and dry. It is loam, clay loam, or gravelly clay loam.

Hoxie Series

The Hoxie series consists of very deep, poorly drained soils in basins. These soils formed in lacustrine material containing some volcanic ash. Slopes are 0 to 1 percent. The mean annual precipitation is about 35 inches, and the mean annual temperature is about 42 degrees F.

Typical pedon of Hoxie silt loam, 0 to 1 percent slopes, near Buck Lake; about 2,450 feet east and 50 feet north of the southwest corner of sec. 12, T. 38 S., R. 5 E.

A—0 to 10 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; moderate very fine subangular blocky structure; soft, friable, slightly sticky and plastic; many fine and very fine roots; many very fine, fine, and medium irregular pores; slightly acid (pH 6.4); abrupt smooth boundary.

BA—10 to 14 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; few fine faint yellowish brown (10YR 5/6) mottles in root channels; moderate coarse and medium prismatic structure; slightly hard, firm, slightly sticky and plastic; common medium and fine roots; common very fine and fine discontinuous pores; slightly acid (pH 6.4); abrupt smooth boundary.

Bw1—14 to 21 inches; grayish brown (2.5Y 5/2) silt loam, light gray (10YR 7/2) dry; common medium prominent and distinct brown (7.5YR 4/4) and strong brown (7.5YR 4/6, 5/6) mottles; moderate

coarse prismatic structure; hard, firm, slightly sticky and plastic; common medium and fine roots; few very fine discontinuous pores; slightly acid (pH 6.2); clear smooth boundary.

2Bw2—21 to 28 inches; grayish brown (2.5Y 5/2) silt loam, light gray (10YR 7/2) dry; common medium prominent and distinct brown (7.5YR 4/4) and strong brown (7.5YR 5/6, 5/8) mottles; moderate coarse prismatic structure; hard, friable, sticky and plastic; common medium and fine roots; few very fine and fine discontinuous pores; accumulations of iron on pore walls and in root channels; strongly acid (pH 5.4); clear smooth boundary.

2BC1—28 to 34 inches; grayish brown (10YR 5/2) very fine sandy loam, light gray (10YR 7/2) dry; common medium prominent and distinct brown (7.5YR 4/4), strong brown (7.5YR 5/6), and dark reddish brown (5YR 3/3) mottles; weak medium and fine subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common medium and fine roots; common very fine discontinuous pores; accumulations of iron on pore walls and in root channels; 3 percent gravel; strongly acid (pH 5.4); clear smooth boundary.

2BC2—34 to 44 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; common medium prominent and distinct strong brown (7.5YR 5/8), reddish brown (5YR 4/4), and yellowish red (5YR 5/6) mottles; massive or weak coarse prismatic structure; hard, friable, slightly sticky and plastic; common medium and fine roots; few very fine and fine discontinuous pores; accumulations of iron on pore walls and in root channels; strongly acid (pH 5.4); gradual smooth boundary.

2C—44 to 65 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; variegated strong brown (7.5YR 4/6, 5/8) and yellowish red (5YR 4/6) mottles; massive; hard, friable, slightly sticky and plastic; few fine and very fine roots; few very fine and fine discontinuous pores; common discontinuous iron cementation; 3 percent gravel; strongly acid (pH 5.4).

The soils are saturated to the surface for at least a month in most years. The depth to bedrock is 60 inches or more. The mollic epipedon is 10 to 18 inches thick. The particle-size control section contains 18 to 30 percent clay and less than 15 percent sand that is coarser than very fine sand. Bulk density is 0.85 to 1.00 gram per cubic centimeter throughout the profile.

The A and BA horizons have value of 2 or 3 moist and chroma of 1 or 2 moist and dry. Dry value is 4 or 5 in the A horizon and 5 to 7 in the BA horizon. The 2Bw, 2BC, and 2C horizons have hue of 10YR or 2.5Y; value of 3 to 5 moist, 5 to 8 dry; and chroma of 1 or 2 moist, 1 to 4 dry. They are silt loam, very fine sandy loam, or silty clay loam.

Hukill Series

The Hukill series consists of deep, well drained soils on plateaus. These soils formed in residuum and colluvium derived from igneous rock. Slopes are 1 to 12 percent. The mean annual precipitation is about 38 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Hukill gravelly loam, 1 to 12 percent slopes, about 2.5 miles east of Butte Falls; about 50 feet north and 50 feet west of the southeast corner of sec. 1, T. 35 S., R. 2 E.

Oi—½ inch to 0; needles, leaves, and twigs.

A—0 to 2 inches; dark reddish brown (5YR 3/2) gravelly loam, dark reddish brown (5YR 3/3) dry; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common medium and coarse roots; many irregular pores; 25 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

AB—2 to 6 inches; dark reddish brown (5YR 3/3) gravelly clay loam, dark reddish brown (5YR 3/4) dry; moderate very fine subangular blocky structure; slightly hard, friable, sticky and plastic; common medium and coarse roots; many very fine tubular pores; 25 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

Bt1—6 to 11 inches; dark reddish brown (2.5YR 3/4) gravelly clay loam, reddish brown (5YR 4/4) dry; moderate very fine and fine subangular blocky structure; hard, friable, sticky and plastic; common medium and coarse roots; many very fine tubular pores; few faint clay films; 15 percent gravel; moderately acid (pH 6.0); clear wavy boundary.

Bt2—11 to 20 inches; dark reddish brown (2.5YR 3/4) gravelly clay, reddish brown (5YR 4/4) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; common very fine tubular pores; common faint and few distinct clay films; 15 percent gravel; few black stains; moderately acid (pH 5.8); gradual wavy boundary.

Bt3—20 to 33 inches; dark reddish brown (2.5YR 3/4) gravelly clay, yellowish red (5YR 4/6) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; common medium roots; common very fine tubular pores; common faint and few distinct clay films; 15 percent gravel; common black stains; moderately acid (pH 5.6); gradual wavy boundary.

2Bt4—33 to 42 inches; dark reddish brown (2.5YR 3/4) gravelly clay, yellowish red (5YR 4/6) dry; moderate

medium subangular blocky structure; hard, firm, sticky and plastic; common very fine tubular pores; common faint clay films; 25 percent gravel; common black stains; strongly acid (pH 5.4); gradual wavy boundary.

2Crt—42 inches; saprolitic andesitic tuff; many faint red (2.5YR 4/6) clay films in fractures; common black stains.

The depth to bedrock is 40 to 60 inches. The particle-size control section contains 35 to 45 percent clay and 10 to 25 percent weathered gravel.

The A horizon has hue of 5YR, 2.5YR, or 7.5YR; value of 3 to 5 dry; and chroma of 2 to 4 moist, 3 or 4 dry. The 2Bt horizon has hue of 2.5YR moist, 2.5YR or 5YR dry, and chroma of 3 to 6 moist and dry. It is gravelly clay, clay, or gravelly clay loam.

Jayar Series

The Jayar series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from altered sedimentary and volcanic rock. Slopes are 12 to 70 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Jayar very gravelly loam, 45 to 70 percent north slopes, about 1 mile southeast of Anderson Butte; about 1,000 feet south and 2,400 feet east of the northwest corner of sec. 12, T. 39 S., R. 2 W.

Oi—1 inch to 0; needles, leaves, and twigs.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) very gravelly loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; soft, friable, slightly sticky and nonplastic; common fine and medium roots; many very fine and fine irregular pores; 35 percent gravel and 5 percent cobbles; moderately acid (pH 5.8); abrupt smooth boundary.

A2—5 to 11 inches; dark brown (10YR 3/3) very gravelly loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; slightly hard, slightly sticky and slightly plastic; common fine and medium roots; common fine tubular pores; 35 percent gravel and 10 percent cobbles; moderately acid (pH 5.8); clear smooth boundary.

BA—11 to 16 inches; dark brown (10YR 4/3) very gravelly loam, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine tubular pores; 40 percent gravel and 5 percent cobbles; moderately acid (pH 5.6); clear smooth boundary.

Bw—16 to 24 inches; dark brown (10YR 4/3) very gravelly loam, light yellowish brown (10YR 6/4) dry; moderate fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine tubular pores; 45 percent gravel and 10 percent cobbles; moderately acid (pH 5.6); abrupt wavy boundary.

R—24 inches; highly fractured and partially weathered metavolcanic rock.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 80 percent rock fragments and 18 to 30 percent clay.

The A horizon has hue of 10YR or 7.5YR; value of 2 to 4 moist, 5 or 6 dry; and chroma of 2 to 4 moist and dry. The BA and Bw horizons have hue of 10YR or 7.5YR; value of 3 to 5 moist, 5 to 7 dry; and chroma of 3 to 6 moist and dry. They are very gravelly loam, very gravelly clay loam, extremely gravelly loam, or very cobbly loam.

Jayar Variant

The Jayar Variant consists of moderately deep, well drained soils on ridges and hillslopes. These soils formed in colluvium derived from altered sedimentary and volcanic rock. Slopes are 5 to 35 percent. The mean annual precipitation is about 55 inches, and the mean annual temperature is about 42 degrees F.

Typical pedon of Jayar Variant very gravelly loam, 5 to 35 percent slopes, about 1 mile northeast of King Mountain; about 1,900 feet east and 2,100 feet north of the southwest corner of sec. 18, T. 33 S., R. 4 W.

A1—0 to 4 inches; very dark brown (10YR 2/2) very gravelly loam, brown (10YR 4/3) dry; strong very fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and common fine, medium, and coarse roots; many irregular pores; 45 percent gravel and 10 percent cobbles; moderately acid (pH 6.0); abrupt smooth boundary.

A2—4 to 8 inches; dark brown (10YR 3/3) very gravelly loam, yellowish brown (10YR 5/4) dry; strong very fine and fine granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine, common fine and medium, and few coarse roots; many very fine tubular and irregular pores; 40 percent gravel and 10 percent cobbles; moderately acid (pH 6.0); clear wavy boundary.

Bw—8 to 24 inches; dark yellowish brown (10YR 4/4) very cobbly loam, yellowish brown (10YR 5/4) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many very fine, common fine and

medium, and few coarse roots; many very fine tubular pores; 20 percent gravel, 15 percent cobbles, and 5 percent stones; moderately acid (pH 5.6); abrupt wavy boundary.

R—24 inches; metavolcanic rock.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 80 percent rock fragments and 18 to 30 percent clay.

The A horizon has hue of 10YR or 7.5YR; value of 2 to 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist and dry. The Bw horizon has hue of 7.5YR or 10YR; value of 3 to 5 moist, 5 to 7 dry; and chroma of 3 to 6 moist and dry. It is very gravelly loam, very gravelly clay loam, or very cobbly loam.

Josephine Series

The Josephine series consists of deep, well drained soils on hillslopes. These soils formed in colluvium and residuum derived from altered sedimentary and volcanic rock. Slopes are 12 to 55 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Josephine gravelly loam, in an area of Josephine-Speaker complex, 12 to 35 percent north slopes, about 0.75 mile northeast of Little Battle Mountain; about 2,360 feet north and 750 feet west of the southeast corner of sec. 3, T. 34 S., R. 3 W.

Oi—1 inch to 0; leaves, needles, and twigs.

A—0 to 3 inches; dark reddish brown (5YR 3/3) gravelly loam, dark brown (7.5YR 4/4) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine irregular pores; 20 percent gravel; slightly acid (pH 6.4); abrupt smooth boundary.

AB—3 to 15 inches; dark reddish brown (5YR 3/4) gravelly loam, reddish brown (5YR 4/4) dry; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine and common medium and coarse roots; many very fine and fine irregular pores; 15 percent gravel; slightly acid (pH 6.2); clear wavy boundary.

Bt1—15 to 22 inches; dark reddish brown (5YR 3/4) gravelly clay loam, reddish brown (5YR 4/4) dry; weak very fine and fine subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and fine and few medium and coarse roots; few very fine tubular pores; very few faint clay films in pores and on rock fragments; 20 percent gravel; moderately acid (pH 6.0); clear wavy boundary.

Bt2—22 to 45 inches; reddish brown (5YR 4/4) gravelly clay loam, yellowish red (5YR 4/6) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine roots; common very fine and fine tubular pores; common distinct clay films in pores and on faces of peds; 20 percent gravel and 5 percent cobbles; moderately acid (pH 5.8); clear broken boundary.

Bt3—45 to 55 inches; reddish brown (5YR 4/4) gravelly clay loam, yellowish red (5YR 4/6) dry; strong fine angular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; common very fine and fine tubular pores; many distinct clay films on faces of peds and in pores; 20 percent gravel and 10 percent cobbles; strongly acid (pH 5.5); abrupt irregular boundary.

Crt—55 inches; partially decomposed metavolcanic rock and schist; many distinct clay films in fracture planes.

The depth to bedrock is 40 to 60 inches. The particle-size control section contains 27 to 35 percent clay and 5 to 35 percent rock fragments.

The A horizon has hue of 5YR to 10YR; value of 2 to 4 moist, 5 or 6 dry; and chroma of 2 to 4 moist and dry. The Bt horizon has hue of 5YR, 2.5YR, or 7.5YR; value of 3 to 5 moist, 4 to 8 dry; and chroma of 4 to 6 moist and dry. It is dominantly clay loam or gravelly clay loam. In some pedons, however, it is very gravelly clay loam below a depth of 40 inches.

Kanid Series

The Kanid series consists of deep, well drained soils on hillslopes. These soils formed in colluvium derived from altered sedimentary and volcanic rock. Slopes are 50 to 80 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Kanid very gravelly loam, in an area of Kanid-Atring very gravelly loams, 50 to 80 percent north slopes, about 13.5 miles north of Wimer; about 1,200 feet east and 700 feet south of the northwest corner of sec. 3, T. 33 S., R. 4 W.

Oi—1 inch to 0; needles, leaves, twigs, and roots.

A—0 to 9 inches; dark brown (10YR 3/3) very gravelly loam, brown (10YR 5/3) dry; strong very fine and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine and fine irregular pores; 50 percent gravel and 5 percent cobbles; moderately acid (pH 5.6); clear wavy boundary.

AB—9 to 18 inches; brown (10YR 4/3) very gravelly

loam, pale brown (10YR 6/3) dry; strong very fine and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many fine irregular pores; 45 percent gravel and 5 percent cobbles; moderately acid (pH 5.6); abrupt wavy boundary.

Bw—18 to 29 inches; yellowish brown (10YR 5/4) very gravelly clay loam, light yellowish brown (10YR 6/4) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine irregular pores; 40 percent gravel and 10 percent cobbles; moderately acid (pH 5.6); abrupt wavy boundary.

BC—29 to 47 inches; light olive brown (2.5Y 5/4) very gravelly clay loam, pale yellow (2.5Y 7/4) dry; weak very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, medium, and coarse roots; many very fine irregular pores; 40 percent gravel and 15 percent cobbles; strongly acid (pH 5.2); abrupt wavy boundary.

Cr—47 inches; highly fractured, metamorphosed sedimentary rock.

The depth to bedrock is 40 to 60 inches. The particle-size control section contains 50 to 80 percent rock fragments and 22 to 30 percent clay.

The A horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 5 or 6 dry; and chroma of 2 to 4 moist and dry. The B horizon has hue of 2.5Y, 10YR, or 7.5YR; value of 3 to 5 moist, 5 to 7 dry; and chroma of 3 to 6 moist and dry. It is very gravelly clay loam, very gravelly loam, or extremely gravelly loam.

Kanutchan Series

The Kanutchan series consists of deep, somewhat poorly drained soils in basins. These soils formed in alluvium and colluvium derived from igneous rock. Slopes are 1 to 8 percent. The mean annual precipitation is about 35 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Kanutchan clay, 1 to 8 percent slopes, about 0.75 mile northeast of Shale City; about 2,700 feet east and 2,850 feet north of the southwest corner of sec. 10, T. 38 S., R. 2 E.

A1—0 to 5 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; strong very fine subangular blocky and fine granular structure; extremely hard, very firm, very sticky and very plastic; many very fine roots; 5 percent gravel; slightly acid (pH 6.2); abrupt smooth boundary.

A2—5 to 10 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; weak medium prismatic structure parting to strong fine subangular blocky; extremely hard, very firm, very sticky and very plastic; many very fine roots; 5 percent gravel; slightly acid (pH 6.2); abrupt smooth boundary.

AB—10 to 20 inches; black (N 2/0) clay, very dark gray (N 3/0) dry; moderate medium and coarse prismatic structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few intersecting slickensides; 5 percent gravel; slightly acid (pH 6.4); clear wavy boundary.

Bw1—20 to 32 inches; black (N 2/0) and very dark gray (2.5Y 3/1) clay, very dark gray (N 3/0) and dark gray (2.5Y 4/1) dry; massive; extremely hard, very firm, very sticky and very plastic; few fine roots; few intersecting slickensides; 5 percent gravel; slightly acid (pH 6.4); abrupt wavy boundary.

Bw2—32 to 46 inches; very dark gray (2.5Y 3/1) clay, dark gray (2.5Y 4/1) dry; massive; very hard, firm, very sticky and very plastic; few fine roots; common intersecting slickensides; slightly acid (pH 6.4); abrupt wavy boundary.

2R—46 inches; gabbro.

The depth to bedrock is 40 to 60 inches. The soils are saturated to the surface for at least 1 month in most years. The particle-size control section contains 45 to 60 percent clay. In most years the soils have cracks that are open to the surface or to the base of a plow layer. These cracks are at least 1 centimeter wide at a depth of 20 inches. The soils have intersecting slickensides.

The A horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 2 or 3 moist, 3 or 4 dry, and chroma of 0 or 1. The AB and Bw horizons are neutral in hue or have hue of 2.5Y to 7.5YR. They have value of 2 or 3 moist, 3 to 5 dry, and chroma of 0 or 1.

Kanutchan Variant

The Kanutchan Variant consists of moderately deep, moderately well drained soils in basins on plateaus. These soils formed in alluvium derived from igneous rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 18 inches, and the mean annual temperature is about 44 degrees F.

Typical pedon of Kanutchan Variant clay, in an area of Booth-Kanutchan Variant complex, 0 to 3 percent slopes; about 1,550 feet north and 100 feet west of the southeast corner of sec. 10, T. 41 S., R. 6 E.

A—0 to 3 inches; dark brown (7.5YR 3/3) clay, brown (7.5YR 4/2) dry; strong very fine angular blocky structure parting to strong thin and medium platy; hard, very firm, very sticky and very plastic; few

very fine and fine roots; many very fine and fine irregular pores; moderately acid (pH 6.0); clear smooth boundary.

Bw1—3 to 15 inches; dark reddish brown (5YR 3/3) clay, dark reddish brown (5YR 3/3) dry; strong coarse and very coarse prismatic and subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine, fine, medium, and coarse roots; common very fine tubular pores; common intersecting slickensides; slightly acid (pH 6.2); clear smooth boundary.

Bw2—15 to 21 inches; dark reddish brown (5YR 3/4) clay, dark reddish brown (5YR 3/3) dry; strong coarse and very coarse prismatic and subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine, fine, medium, and coarse roots; common very fine tubular pores; common intersecting slickensides; slightly acid (pH 6.2); abrupt smooth boundary.

R—21 inches; tuff.

The depth to bedrock is 20 to 40 inches. The soils are saturated to the surface for at least 1 month in most years. The particle-size control section contains 40 to 60 percent clay. In most years the soils have cracks that are open to the surface or to the base of a plow layer. These cracks are at least 1 centimeter wide at a depth of 20 inches. The soils have intersecting slickensides.

The A horizon has value of 2 or 3 moist, 3 or 4 dry, and chroma of 2 or 3 moist and dry. The Bw horizon has value of 3 moist, 3 or 4 dry, and chroma of 3 or 4 moist and dry.

Kerby Series

The Kerby series consists of very deep, well drained and moderately well drained soils on stream terraces. These soils formed in alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is about 25 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Kerby loam, 0 to 3 percent slopes, about 1 mile north of Central Point; about 500 feet north and 1,500 feet west of the southeast corner of sec. 35, T. 36 S., R. 2 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; strong fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many roots; many fine irregular pores; slightly acid (pH 6.5); abrupt smooth boundary.

BA—7 to 14 inches; dark brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; many roots; many fine irregular and few very fine tubular pores; 5 percent gravel; slightly acid (pH 6.5); clear smooth boundary.

Bw1—14 to 39 inches; dark brown (10YR 4/3) loam, brown (10YR 5/3) dry; weak coarse prismatic structure; slightly hard, firm, sticky and plastic; few fine roots; few fine tubular pores; 10 percent gravel; slightly acid (pH 6.5); gradual smooth boundary.

Bw2—39 to 54 inches; dark brown (10YR 4/3) loam, yellowish brown (10YR 5/4) dry; weak coarse prismatic structure; slightly hard, friable, sticky and plastic; few fine roots; few fine tubular pores; 10 percent gravel; slightly acid (pH 6.5); clear wavy boundary.

2C—54 to 60 inches; dark brown (10YR 4/3) very gravelly sandy loam, yellowish brown (10YR 5/6) dry; massive; slightly hard, friable, nonsticky and nonplastic; 35 percent gravel; slightly acid (pH 6.5).

The depth to bedrock is 60 inches or more. The solum is 40 to 60 inches thick. The particle-size control section contains 18 to 35 percent clay.

The A horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist and dry. The Bw horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 4 to 6 moist and dry. It is loam, clay loam, or gravelly loam. The 2C horizon, if it occurs, is stratified loam, sandy loam, or sand in the fine-earth fraction and contains 0 to 85 percent rock fragments, mostly gravel.

Killet Series

The Killet series consists of very deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium derived from igneous rock and containing volcanic ash. Slopes are 3 to 35 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Killet gravelly loam, in an area of Donegan-Killet gravelly loams, 12 to 35 percent north slopes; about 1,500 feet east and 2,450 feet north of the southwest corner of sec. 35, T. 33 S., R. 2 E.

Oi—2 inches to 0; leaves, needles, and twigs.

A1—0 to 8 inches; dark reddish brown (5YR 3/2) gravelly loam, brown (7.5YR 4/2) dry; strong fine and medium granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; many very fine and fine irregular pores; 15 percent gravel; slightly acid (pH 6.5); abrupt smooth boundary.

A2—8 to 18 inches; dark reddish brown (5YR 3/2) gravelly loam, dark reddish gray (5YR 4/2) dry;

moderate very fine and fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; common very fine tubular pores; 25 percent gravel and 7 percent cobbles; slightly acid (pH 6.4); clear wavy boundary.

Bw1—18 to 38 inches; dark reddish brown (5YR 3/3) gravelly clay loam, reddish brown (5YR 4/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common very fine, fine, medium, and coarse roots; common very fine tubular pores; 25 percent gravel and 7 percent cobbles; slightly acid (pH 6.2); clear wavy boundary.

Bw2—38 to 60 inches; dark reddish brown (5YR 3/3) clay loam, reddish brown (5YR 4/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few very fine, fine, and medium roots; common very fine tubular pores; 5 percent gravel; slightly acid (pH 6.2).

The depth to bedrock is 60 inches or more. The particle-size control section contains 27 to 35 percent clay and 10 to 35 percent rock fragments. The umbric epipedon is 20 to 40 inches thick.

The A horizon has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3 moist, 3 to 5 dry; and chroma of 2 or 3 moist and dry. The Bw horizon has hue of 7.5YR or 5YR; value of 3 or 4 moist, 4 or 5 dry; and chroma of 2 or 3 moist, 3 or 4 dry. It is clay loam, gravelly clay loam, or cobbly clay loam.

Klamath Series

The Klamath series consists of very deep, poorly drained soils on flood plains. These soils formed in alluvium derived from igneous rock and volcanic ash. Slopes are 0 to 1 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 44 degrees F.

Typical pedon of Klamath silt loam, 0 to 1 percent slopes, about 5 miles northeast of Pinehurst; about 1,500 feet west and 1,800 feet south of the northeast corner of sec. 18, T. 39 S., R. 5 E.

A—0 to 3 inches; black (N 2/0) silt loam, black (10YR 2/1) dry; strong fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and common medium roots; many very fine irregular pores; strongly acid (pH 5.2); abrupt smooth boundary.

BA—3 to 11 inches; black (N 2/0) clay, dark gray (10YR 4/1) dry; strong coarse prismatic structure; hard, very firm, sticky and plastic; common very fine and few fine and medium roots; many very fine tubular pores; slightly acid (pH 6.2); clear wavy boundary.

Bw1—11 to 20 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; strong coarse prismatic structure; very hard, very firm, sticky and plastic; common very fine roots; many very fine tubular pores; slightly acid (pH 6.2); gradual wavy boundary.

Bw2—20 to 37 inches; dark gray (10YR 4/1) silty clay, light gray (10YR 6/1) dry; common medium prominent strong brown (7.5YR 4/6) mottles; weak coarse subangular blocky structure; hard, very firm, sticky and plastic; few very fine roots; many very fine tubular pores; moderately acid (pH 5.8); gradual wavy boundary.

C1—37 to 49 inches; gray (10YR 5/1) silty clay loam, light gray (10YR 7/1) dry; common medium prominent strong brown (7.5YR 4/6) mottles; massive; hard, firm, sticky and plastic; few very fine roots; many very fine and medium tubular pores; 3 percent gravel; moderately acid (pH 5.8); gradual wavy boundary.

C2—49 to 62 inches; gray (10YR 5/1) clay loam, light gray (10YR 7/1) dry; common medium prominent strong brown (7.5YR 4/6) mottles; massive; hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; 5 percent gravel; moderately acid (pH 5.8).

The soils are saturated to the surface for at least 1 month in most years. The depth to bedrock is 60 inches or more. The particle-size control section contains 35 to 45 percent clay. The mollic epipedon is 24 to 40 inches thick. The soils are characterized by an irregular decrease in content of organic matter to a depth of 50 inches.

The A horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 2 to 5 dry and chroma of 0 to 1 moist and dry. The B horizon has value of 2 to 4 moist, 4 to 7 dry, and chroma of 0 to 2 moist and dry. This horizon is mottled in pedons where dry value is 6 or more. It is silty clay or clay. The C horizon has value of 3 to 5 moist, 6 or 7 dry, and chroma of 0 to 2 moist, 0 or 1 dry. It is silty clay loam, silty clay, or clay loam.

Kubli Series

The Kubli series consists of very deep, somewhat poorly drained soils on stream terraces. These soils formed in alluvium derived from granitic rock and are underlain by older alluvium. Slopes are 0 to 7 percent. The mean annual precipitation is about 25 inches, and the mean annual temperature is about 52 degrees F.

Typical pedon of Kubli loam, 0 to 3 percent slopes, about 1 mile southwest of Central Point; about 1,200

feet south and 400 feet east of the northwest corner of sec. 15, T. 37 S., R. 2 W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; neutral (pH 6.8); abrupt smooth boundary.

A—9 to 15 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; common fine faint dark brown (7.5YR 4/4) mottles; weak medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine tubular pores; coatings that are light brownish gray (10YR 6/2) dry; neutral (pH 6.8); clear smooth boundary.

Bw1—15 to 25 inches; dark grayish brown (10YR 4/2) loam, brown (10YR 5/3) dry; common medium faint dark brown (7.5YR 4/4) and dark grayish brown (2.5Y 4/2) mottles; weak medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine tubular pores; neutral (pH 6.8); gradual smooth boundary.

Bw2—25 to 31 inches; dark grayish brown (10YR 4/2) loam, brown (10YR 5/3) dry; common medium and large distinct reddish brown (5YR 4/4) mottles; weak medium and coarse subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine tubular pores; neutral (pH 6.8); abrupt smooth boundary.

2C1—31 to 47 inches; brown (10YR 4/3) clay, brown (10YR 5/3) and light brownish gray (2.5Y 6/2) dry; massive; extremely hard, very firm, sticky and plastic; common very fine tubular pores; neutral (pH 6.6); clear smooth boundary.

2C2—47 to 60 inches; brown (10YR 4/3) clay loam that has very dark grayish brown (2.5Y 3/2) coatings; light brownish gray (2.5Y 6/2, 10YR 6/2) and pale brown (10YR 6/3) dry; massive; hard, firm, slightly sticky and slightly plastic; neutral (pH 6.8).

The depth to bedrock is 60 inches or more. Depth to the clayey substratum is 25 to 35 inches. The upper part of the particle-size control section contains 18 to 25 percent clay, and the lower part contains 35 to 50 percent clay.

The A horizon has value of 2 or 3 moist and chroma of 1 or 2 moist, 2 or 3 dry. The Bw horizon has hue of 10YR or 2.5Y; value of 3 to 5 moist, 4 to 6 dry; and chroma of 2 or 3 moist and dry. The 2C horizon has hue of 10YR or 2.5Y; value of 4 or 5 moist, 5 or 6 dry; and chroma of 2 or 3 moist and dry. It is clay loam or clay.

Langellain Series

The Langellain series consists of moderately deep, moderately well drained soils on ridges, knolls, and hillslopes. These soils formed in colluvium and alluvium derived from sedimentary rock. Slopes are 1 to 40 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Langellain loam, in an area of Langellain-Brader loams, 1 to 7 percent slopes, about 100 feet west of an unnamed paved road in Sams Valley; about 250 feet west and 1,350 feet south of the northeast corner of sec. 21, T. 35 S., R. 2 W.

Oi—½ inch to 0; grasses, twigs, and leaves.

A1—0 to 6 inches; dark reddish brown (5YR 3/3) loam, brown (10YR 5/3) dry; moderate fine granular structure; slightly hard, very friable, nonsticky and nonplastic; common fine roots; many fine irregular pores; slightly acid (pH 6.2); abrupt smooth boundary.

A2—6 to 10 inches; dark brown (7.5YR 3/4) loam, brown (10YR 5/3) dry; moderate fine and very fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine roots; many fine and medium irregular pores; moderately acid (pH 6.0); abrupt irregular boundary.

Bt1—10 to 21 inches; strong brown (7.5YR 4/6) loam, brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; hard, friable, slightly sticky and plastic; common fine and medium roots; many fine and medium irregular pores; common faint clay films in pores and few faint clay films on faces of peds; moderately acid (pH 5.6); abrupt wavy boundary.

Bt2—21 to 33 inches; brown (10YR 4/3) clay, grayish brown (10YR 5/2) dry; common medium faint and distinct strong brown (7.5YR 5/6, 4/6) and brown (7.5YR 4/4) mottles, dominantly in the upper 3 inches; strong medium prismatic structure; extremely hard, firm, sticky and very plastic; few fine and medium roots; few fine tubular pores; common distinct clay films on faces of peds and in pores; strongly acid (pH 5.4); clear wavy boundary.

Bt3—33 to 38 inches; yellowish brown (10YR 5/4) clay, grayish brown (10YR 5/2) dry; strong medium prismatic structure; very hard, firm, sticky and very plastic; few fine and medium roots; few fine tubular pores; common distinct clay films on faces of peds and in pores; strongly acid (pH 5.2); clear wavy boundary.

2Cr—38 inches; decomposed sandstone.

The depth to bedrock is 20 to 40 inches. Depth to the clayey subsoil is 12 to 28 inches. The upper part of the particle-size control section contains 20 to 35 percent clay, and the lower part contains 45 to 60 percent clay.

The A horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 to 6 dry; and chroma of 2 to 4 moist and dry. The Bt horizon has hue of 5YR, 7.5YR, or 10YR; value of 3 to 5 moist, 4 to 6 dry; and chroma of 1 to 6 moist and dry. It is loam or clay loam. The 2Bt horizon has hue of 2.5Y, 10YR, or 7.5YR; value of 4 or 5 moist, 4 to 8 dry; and chroma of 1 to 6 moist and dry. It has faint to prominent mottles.

Lettia Series

The Lettia series consists of deep, well drained soils on hillslopes and old slump benches. These soils formed in colluvium and residuum derived from granitic rock (fig. 17). Slopes are 12 to 35 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Lettia sandy loam, 12 to 35 percent south slopes, near Elderberry Flat along West Evans Creek; about 2,000 feet east and 2,500 feet north of the southwest corner of sec. 31, T. 33 S., R. 3 W.

Oi—2 inches to 0; twigs, needles, and leaves.

A1—0 to 3 inches; dark brown (10YR 3/3) sandy loam, light yellowish brown (10YR 6/4) dry; strong very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many fine and medium irregular pores; 12 percent gravel; moderately acid (pH 5.6); abrupt smooth boundary.

A2—3 to 8 inches; brown (7.5YR 4/4) loam, light brown (7.5YR 6/4) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; 5 percent gravel; strongly acid (pH 5.4); abrupt smooth boundary.

AB—8 to 14 inches; reddish brown (5YR 4/4) loam, reddish yellow (7.5YR 7/6) dry; strong fine and medium subangular blocky structure; hard, firm, sticky and plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; 3 percent gravel; strongly acid (pH 5.2); clear smooth boundary.

Bt1—14 to 26 inches; red (2.5YR 4/6) clay loam, yellowish red (5YR 5/6) dry; strong fine and medium angular blocky structure; very hard, firm, sticky and plastic; few very fine, fine, and medium roots; few very fine tubular pores; common faint clay films on faces of peds and in pores; 2 percent gravel; strongly acid (pH 5.2); clear smooth boundary.

Figure 17.—Profile of a Lettia sandy loam, which formed in colluvium and residuum derived from granitic rock. The surface layer is about 2 feet thick, and the subsoil extends to a depth of about 6 feet.

Bt2—26 to 47 inches; red (2.5YR 4/8) loam, red (2.5YR 5/8) dry; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine, fine, and medium roots; few very fine tubular pores; common faint clay films on faces of peds and in pores; 5 percent gravel; strongly acid (pH 5.2); gradual wavy boundary.

Bt3—47 to 55 inches; red (2.5YR 5/8) loam, reddish

yellow (5YR 6/6) and pink (5YR 7/4) dry; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and nonplastic; few faint clay films on faces of peds; 2 percent gravel; strongly acid (pH 5.2).
Cr—55 inches; decomposed granodiorite.

The depth to bedrock is 40 to 60 inches. The particle-size control section contains 20 to 35 percent clay and 15 to 50 percent coarse sand and very coarse sand.

The A horizon has hue of 7.5YR or 10YR; value of 3 to 5 moist, 4 to 7 dry; and chroma of 2 to 4 moist and dry. The Bt horizon has hue of 7.5YR, 5YR, or 2.5YR; value of 4 to 6 moist, 5 to 7 dry; and chroma of 4 to 8 moist and dry. It is loam, sandy clay loam, or clay loam. Some pedons have a C horizon. This horizon has hue of 10YR, 7.5YR, 5YR, or 2.5YR; value of 4 or 5 moist, 5 to 7 dry; and chroma of 4 to 8 moist and dry. It is loam to coarse sandy loam.

Lobert Series

The Lobert series consists of very deep, well drained soils on stream terraces. These soils formed in alluvial and lacustrine sediment weathered from tuff and volcanic ash. Slopes are 0 to 12 percent. The mean annual precipitation is about 17 inches, and the mean annual temperature is about 44 degrees F.

Typical pedon of Lobert sandy loam, 0 to 12 percent slopes, northwest of Round Lake; about 2,325 feet south and 1,900 feet west of the northeast corner of sec. 35, T. 38 S., R. 7 E.

Oi—2 inches to 0; needles and twigs.
A—0 to 10 inches; dark reddish brown (5YR 3/3) sandy loam, reddish brown (5YR 4/3) dry; moderate very fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium and few coarse roots; many very fine pores; moderately acid (pH 6.0); clear smooth boundary.
AB—10 to 20 inches; dark reddish brown (5YR 3/3) sandy loam, reddish brown (5YR 4/3) dry; moderate very fine and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium and few coarse roots; common very fine tubular pores; moderately acid (pH 5.8); abrupt wavy boundary.
Bw1—20 to 34 inches; dark reddish brown (5YR 3/3) loam, brown (7.5YR 5/3) dry; moderate fine and medium subangular blocky structure; hard, firm, nonsticky and slightly plastic; few fine, medium, and coarse and common very fine roots; common very fine tubular pores; moderately acid (pH 5.6); clear wavy boundary.
Bw2—34 to 41 inches; dark reddish brown (5YR 3/3) loam, brown (7.5YR 5/3) dry; weak medium and coarse subangular blocky structure; hard, firm, nonsticky and slightly plastic; few very fine, fine, medium, and coarse roots; common very fine tubular pores; moderately acid (pH 5.6); abrupt wavy boundary.
2Bt—41 to 60 inches; dark brown (7.5YR 3/3) loam, brown (7.5YR 4/4) and yellowish brown (10YR 5/4) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine, fine, medium, and coarse roots; common very fine pores; common faint clay films on faces of peds and in pores; moderately acid (pH 5.6).

The depth to bedrock is 60 inches or more. The particle-size control section contains 10 to 18 percent clay. The mollic epipedon is 20 to 45 inches thick.

The A horizon has hue of 5YR, 7.5YR, or 10YR; value of 2 or 3 moist, 4 or 5 dry; and chroma of 2 or 3 moist and dry. The Bw and 2Bt horizons have hue of 10YR, 7.5YR, or 5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist and dry. They are loam, fine sandy loam, or sandy loam.

Lorella Series

The Lorella series consists of shallow, well drained soils on hillslopes. These soils formed in colluvium and residuum derived from igneous rock. Slopes are 15 to 35 percent. The mean annual precipitation is about 18 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Lorella very stony loam, in an area of Lorella-Skookum complex, 15 to 35 percent slopes, about 4 miles southwest of Round Lake; about 2,325 feet east and 1,000 feet north of the southwest corner of sec. 34, T. 39 S., R. 7 E.

A—0 to 5 inches; very dark brown (10YR 2/2) extremely stony loam, brown (10YR 4/3) dry; moderate very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and common fine and medium roots; many very fine pores; 30 percent stones, 10 percent gravel, and 20 percent cobbles; moderately acid (pH 5.8); clear wavy boundary.
BA—5 to 9 inches; very dark brown (10YR 2/2) very cobbly clay loam, brown (10YR 4/3) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and common fine and medium roots; many very fine tubular pores; 10 percent gravel and 25 percent cobbles; moderately acid (pH 6.0); abrupt wavy boundary.

Bt—9 to 17 inches; dark brown (7.5YR 3/2) very cobbly clay loam, brown (10YR 4/3) dry; moderate very fine and fine subangular blocky structure; hard, friable, sticky and plastic; common very fine, fine, and medium roots; many very fine tubular pores; many distinct clay films on faces of peds and in pores; 15 percent gravel and 20 percent cobbles; slightly acid (pH 6.2); abrupt wavy boundary.

R—17 inches; tuff.

The depth to bedrock is 12 to 20 inches. The particle-size control section contains 35 to 50 percent clay and 35 to 60 percent rock fragments.

The A horizon has value of 2 or 3 moist, 4 or 5 dry, and chroma of 2 or 3 moist and dry. The Bt horizon has hue of 10YR or 7.5YR; value of 2 to 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist and dry. It is very cobbly clay loam or very cobbly clay.

Manita Series

The Manita series consists of deep, well drained soils on alluvial fans and hillslopes. These soils formed in alluvium and colluvium derived from altered sedimentary and volcanic rock. Slopes are 2 to 50 percent. The mean annual precipitation is 30 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Manita loam, in an area of Manita-Vannoy complex, 20 to 40 percent slopes, about 4 miles west of Phoenix; about 2,400 feet west and 2,000 feet south of the northeast corner of sec. 11, T. 38 S., R. 2 W.

A1—0 to 4 inches; dark brown (7.5YR 3/2) loam, brown (7.5YR 5/3) dry; moderate fine and very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; slightly acid (pH 6.2); abrupt smooth boundary.

A2—4 to 8 inches; dark brown (7.5YR 3/3) loam, brown (7.5YR 5/3) dry; moderate medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine tubular pores; slightly acid (pH 6.2); clear smooth boundary.

Bt1—8 to 13 inches; dark reddish brown (5YR 3/4) clay loam, brown (7.5YR 5/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine roots; many very fine tubular pores; few faint dark reddish brown (5YR 3/5) clay films on faces of peds; moderately acid (pH 6.0); clear smooth boundary.

Bt2—13 to 28 inches; yellowish red (5YR 3/6) clay loam, yellowish red (5YR 4/6) dry; moderate fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; few fine and medium roots; many fine and very fine tubular pores; common faint and few distinct clay films on faces of peds and in tubular pores; moderately acid (pH 6.0); clear wavy boundary.

Bt3—28 to 45 inches; yellowish red (5YR 3/6) clay loam, yellowish red (5YR 4/6) dry; moderate fine subangular blocky structure; very hard, firm, very sticky and very plastic; few medium roots; many very fine tubular pores; common faint and distinct clay films on faces of peds and in tubular pores; few black stains; moderately acid (pH 5.8); clear smooth boundary.

Bt4—45 to 58 inches; yellowish red (5YR 3/6) clay loam, yellowish red (5YR 4/6) dry; weak medium subangular blocky structure; very hard, firm, very sticky and very plastic; common very fine tubular pores; common faint and few distinct clay films on faces of peds and in tubular pores; 5 percent partially weathered gravel; few black concretions and common black stains; moderately acid (pH 5.7); abrupt wavy boundary.

Cr—58 inches; partially weathered siltstone.

The depth to bedrock is 40 to 60 inches. The particle-size control section contains 35 to 45 percent clay.

The A horizon has hue of 5YR, 7.5YR, or 10YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist and dry. The Bt horizon has hue of 2.5YR, 5YR, or 7.5YR; value of 3 to 5 moist, 4 to 6 dry; and chroma of 4 to 6 moist and dry. It is clay loam, silty clay, or clay.

McMullin Series

The McMullin series consists of shallow, well drained soils on hillslopes and plateaus. These soils formed in colluvium derived from igneous rock and altered sedimentary rock. Slopes are 1 to 70 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of McMullin gravelly loam, in an area of McMullin-Rock outcrop complex, 3 to 35 percent slopes, about 1 mile southeast of Butte Falls Highway; about 2,250 feet south and 1,150 feet east of the northwest corner of sec. 8, T. 35 S., R. 1 E.

A1—0 to 2 inches; dark reddish brown (5YR 3/3) gravelly loam, brown (7.5YR 4/4) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; common very fine irregular pores; 20 percent gravel; slightly acid (pH 6.3); clear smooth boundary.

A2—2 to 7 inches; dark reddish brown (5YR 3/3) gravelly loam, brown (7.5YR 4/4) dry; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine irregular and few fine tubular pores; 15 percent gravel; slightly acid (pH 6.2); clear smooth boundary.
Bw—7 to 17 inches; dark reddish brown (5YR 3/4) gravelly clay loam, reddish brown (5YR 4/4) dry; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; few medium and many very fine and fine roots; many very fine and fine irregular and few fine tubular pores; 15 percent gravel and 5 percent cobbles; moderately acid (pH 6.0); abrupt irregular boundary.
R—17 inches; fractured andesite.

The depth to bedrock is 12 to 20 inches. The particle-size control section contains 15 to 25 percent rock fragments and 20 to 35 percent clay.

The A horizon has hue of 5YR, 7.5YR, or 10YR; value of 2 or 3 moist, 4 or 5 dry; and chroma of 2 or 3 moist, 3 or 4 dry. The Bw horizon has hue of 5YR, 7.5YR, or 10YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 3 or 4 moist and dry. It is gravelly loam, gravelly clay loam, or cobbly clay loam.

McNull Series

The McNull series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from igneous rock. Slopes are 12 to 60 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of McNull loam, 12 to 35 percent north slopes, about 5 miles northeast of Eagle Point; about 1,400 feet south and 1,100 feet east of the northwest corner of sec. 8, T. 35 S., R. 1 E.

Oi—1 inch to 0; leaves, needles, and twigs.
A1—0 to 2 inches; dark reddish brown (5YR 3/3) loam, brown (7.5YR 4/2) dry; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine and fine irregular pores; 10 percent gravel; slightly acid (pH 6.4); abrupt smooth boundary.
A2—2 to 6 inches; dark reddish brown (5YR 3/3) loam, brown (7.5YR 4/2) dry; moderate fine subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; common very fine and fine roots; many very fine and fine irregular pores; 10 percent gravel; slightly acid (pH 6.1); clear wavy boundary.
Bt1—6 to 12 inches; dark reddish brown (5YR 3/3) clay loam, dark brown (7.5YR 4/2) dry; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common very fine, fine, and medium roots; common fine irregular and few very fine tubular pores; few faint clay films on faces of peds and in pores; 10 percent gravel; moderately acid (pH 6.0); clear wavy boundary.
Bt2—12 to 25 inches; dark reddish brown (5YR 3/4) cobbly clay, dark brown (7.5YR 3/4) dry; moderate medium angular blocky structure; very hard, firm, very sticky and very plastic; common very fine, fine, and medium roots; common very fine irregular and common fine tubular pores; many distinct clay films on faces of peds and in pores; 10 percent gravel and 10 percent cobbles; moderately acid (pH 5.8); gradual irregular boundary.
Bt3—25 to 32 inches; dark reddish brown (5YR 3/4) cobbly clay, brown (7.5YR 4/4) dry; moderate medium angular blocky structure; very hard, firm, very sticky and very plastic; common very fine, fine, and medium roots; common very fine irregular and common fine tubular pores; many distinct clay films on faces of peds and in pores; 10 percent gravel and 10 percent cobbles; moderately acid (pH 5.8); abrupt irregular boundary.
Crt—32 inches; fractured andesite; many distinct dark brown (5YR 4/4) clay films in fractures.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 50 percent clay and 10 to 35 percent rock fragments.

The A horizon has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3 moist, 3 to 5 dry; and chroma of 2 or 3 moist and dry. It is loam or gravelly loam. The Bt horizon has hue of 10YR, 7.5YR, or 5YR; value of 3 to 5 moist and dry; and chroma of 3 to 6 moist and dry. It is clay loam, clay, or cobbly clay.

Medco Series

The Medco series consists of moderately deep, moderately well drained soils on hillslopes. These soils formed in alluvium and colluvium derived from igneous rock. Slopes are 1 to 50 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Medco cobbly clay loam, in an area of Medco-McMullin complex, 12 to 50 percent slopes, about 2.5 miles east of Brownsboro; about 2,255 feet east and 2,495 feet north of the southwest corner of sec. 35, T. 35 S., R. 1 E.

A1—0 to 2 inches; very dark brown (10YR 2/2) cobbly clay loam, dark gray (10YR 4/1) dry; weak fine and medium granular structure; slightly hard, very

friable, slightly sticky and slightly plastic; common fine and medium roots; many very fine irregular pores; 5 percent gravel and 10 percent cobbles; neutral (pH 6.7); abrupt smooth boundary.

A2—2 to 7 inches; very dark grayish brown (10YR 3/2) cobbly clay loam, gray (10YR 5/1) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and medium and few coarse roots; common very fine irregular and few very fine tubular pores; 5 percent gravel and 10 percent cobbles; neutral (pH 6.6); clear wavy boundary.

A3—7 to 12 inches; very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) cobbly clay loam, gray (10YR 5/1) and grayish brown (10YR 5/2) dry; few fine faint dark reddish brown (5YR 3/3) mottles; strong fine and medium subangular blocky structure; hard, firm, sticky and plastic; common medium and few fine and coarse roots; common very fine irregular and tubular pores; 10 percent gravel and 10 percent cobbles; slightly acid (pH 6.1); abrupt smooth boundary.

Bw1—12 to 22 inches; brown (10YR 5/3, 7.5YR 4/2) clay, pale brown (10YR 6/3) and light brownish gray (10YR 6/2) dry; strong fine and medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; few medium and coarse roots; few very fine irregular pores; many prominent stress cutans; 5 percent gravel; moderately acid (pH 5.9); gradual smooth boundary.

2Bw2—22 to 30 inches; brown (10YR 5/3) clay, very pale brown (10YR 7/3) dry; strong medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; few medium and coarse roots; few very fine tubular pores; many prominent stress cutans; 5 percent gravel; strongly acid (pH 5.3); abrupt irregular boundary.

3Cr—30 inches; partially weathered tuff.

The depth to bedrock is 20 to 40 inches. Depth to the clayey subsoil is 6 to 18 inches. The particle-size control section contains 50 to 60 percent clay and 5 to 30 percent rock fragments.

The A horizon has hue of 7.5YR or 10YR and value of 2 or 3 moist, 4 or 5 dry. It is clay loam or cobbly clay loam. The 2Bw horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 4 or 5 moist, 4 to 7 dry; and chroma of 2 to 4 moist, 2 or 3 dry. It is clay or cobbly clay.

Medford Series

The Medford series consists of very deep, moderately well drained soils on stream terraces. These soils formed in mixed alluvium derived from altered sedimentary and volcanic rock. Slopes are 0 to 7 percent. The mean annual precipitation is about 25 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Medford silty clay loam, 0 to 3 percent slopes, about 1 mile north of Central Point; about 1,220 feet north and 580 feet east of the southwest corner of sec. 35, T. 36 S., R. 2 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate fine subangular blocky and granular structure; very hard, firm, sticky and plastic; many very fine roots; many very fine irregular pores; neutral (pH 6.6); abrupt smooth boundary.

A—8 to 12 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; slightly acid (pH 6.4); clear smooth boundary.

Bt1—12 to 22 inches; very dark brown (10YR 2/2) silty clay, dark grayish brown (10YR 4/2) dry; moderate fine prismatic structure parting to moderate fine subangular blocky; very hard, firm, very sticky and very plastic; few medium roots; many very fine tubular pores; many distinct clay films on faces of peds; slightly acid (pH 6.4); clear smooth boundary.

Bt2—22 to 35 inches; dark brown (10YR 3/3) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine prismatic structure parting to moderate fine subangular blocky; very hard, firm, sticky and very plastic; few medium roots; many very fine tubular pores; common distinct very dark brown (10YR 2/2) clay films on faces of peds and in tubular pores; moderately acid (pH 6.4); gradual wavy boundary.

Bt3—35 to 44 inches; dark yellowish brown (10YR 3/4) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; very hard, firm, sticky and very plastic; few medium roots; many very fine tubular pores; common faint dark brown (10YR 3/3) clay films on faces of peds and in tubular pores; slightly acid (pH 6.4); gradual wavy boundary.

Bt4—44 to 53 inches; dark yellowish brown (10YR 3/4) clay loam, dark brown (10YR 4/3) dry; weak medium subangular blocky structure; very hard, firm, sticky and very plastic; few medium roots; many very fine tubular pores; common faint dark brown (10YR 3/3) clay films on faces of peds and in tubular pores; slightly acid (pH 6.4); gradual wavy boundary.

2BCt—53 to 71 inches; dark yellowish brown (10YR 3/4) sandy clay loam, dark brown (10YR 4/3) dry; massive; hard, firm, sticky and plastic; common fine

tubular pores; few faint dark brown (10YR 3/3) clay films in tubular pores; slightly acid (pH 6.4).

The depth to bedrock is 60 inches or more. The particle-size control section contains 35 to 45 percent clay. The mollic epipedon is 20 to 40 inches thick. Some pedons have very gravelly layers below a depth of 40 inches.

The A horizon has value of 2 or 3 moist, 3 to 5 dry, and chroma of 1 or 2 dry. It is clay loam or silty clay loam. The Bt horizon has value of 2 to 4 moist, 4 to 6 dry, and chroma of 2 to 4 moist and dry. It is silty clay loam, clay, silty clay, or clay loam. The 2BC horizon, if it occurs, is sandy clay loam, clay loam, or silty clay loam in the fine-earth fraction and contains 0 to 60 percent rock fragments.

Merlin Series

The Merlin series consists of shallow, well drained soils on plateaus. These soils formed in residuum weathered from igneous rock. Slopes are 1 to 8 percent. The mean annual precipitation is about 18 inches, and the mean annual temperature is about 44 degrees F.

Typical pedon of Merlin extremely stony loam, 1 to 8 percent slopes, about 1.5 miles southwest of Round Lake; about 1,225 feet west and 2,150 feet south of the northeast corner of sec. 14, T. 39 S., R. 7 E.

A1—0 to 3 inches; dark brown (7.5YR 3/2) extremely stony loam, brown (7.5YR 5/2) dry; moderate very fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots; common very fine irregular pores; 30 percent stones, 30 percent cobbles, and 10 percent gravel; slightly acid (pH 6.1); clear smooth boundary.

A2—3 to 11 inches; dark brown (7.5YR 3/3) extremely stony loam, brown (7.5YR 5/3) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; 30 percent stones, 30 percent cobbles, and 10 percent gravel; slightly acid (pH 6.1); abrupt wavy boundary.

Bt—11 to 13 inches; dark brown (7.5YR 3/4) clay, brown (7.5YR 5/4) dry; moderate fine angular blocky structure; very hard, very firm, sticky and plastic; common very fine roots; common very fine tubular pores; many distinct clay films on faces of peds and in pores; 10 percent gravel and 4 percent cobbles; slightly acid (pH 6.1); abrupt wavy boundary.

R—13 inches; andesite.

The depth to bedrock is 10 to 20 inches. The particle-size control section contains 60 to 70 percent clay and 0 to 15 percent rock fragments.

The A horizon has hue of 7.5YR or 10YR; value of 2 or 3 moist, 4 or 5 dry; and chroma of 2 or 3 moist, 1 to 3 dry. The Bt horizon has hue of 7.5YR or 10YR; value of 3 or 4 moist, 4 or 5 dry; and chroma of 2 to 4 moist and dry.

Musty Series

The Musty series consists of moderately deep, well drained soils on ridges and hillslopes. These soils formed in colluvium derived from altered volcanic rock. Slopes are 12 to 50 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Musty gravelly loam, in an area of Musty-Goolaway complex, 12 to 35 percent slopes; about 650 feet west and 1,350 feet north of the southeast corner of sec. 13, T. 33 S., R. 3 W.

Oi—1 inch to 0; needles and twigs.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (2.5Y 5/2) dry; strong fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine irregular pores; 15 percent gravel; moderately acid (pH 5.8); clear smooth boundary.

A2—3 to 12 inches; very dark grayish brown (2.5Y 3/2) gravelly loam, grayish brown (2.5Y 5/2) dry; moderate very fine and fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine tubular pores; 20 percent gravel; moderately acid (pH 5.6); clear wavy boundary.

Bw—12 to 29 inches; dark grayish brown (2.5Y 4/2) very cobbly loam, light brownish gray (2.5Y 6/2) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine tubular pores; 20 percent cobbles and 30 percent gravel; moderately acid (pH 5.6); abrupt wavy boundary.

R—29 inches; fractured schist.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 70 percent rock fragments and 15 to 25 percent clay. The umbric epipedon is 10 to 20 inches thick.

The A horizon has hue of 10YR, 2.5Y, or 5Y; value of 2 or 3 moist, 3 to 5 dry; and chroma of 1 or 2 moist, 2 or 3 dry. The Bw horizon has hue of 10YR, 2.5Y, or 5Y; value of 3 or 4 moist, 5 or 6 dry; and chroma of 2 or

3 moist and dry. It is very cobbly or extremely cobbly loam.

Newberg Series

The Newberg series consists of very deep, somewhat excessively drained soils on flood plains. These soils formed in alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 52 degrees F.

Typical pedon of Newberg fine sandy loam, 0 to 3 percent slopes, about 1 mile south of Upper Table Rock; about 1,780 feet north and 1,500 feet east of the southwest corner of sec. 12, T. 36 S., R. 2 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; single grain; loose, very friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; moderately acid (pH 6.0); clear smooth boundary.

A—9 to 17 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine irregular pores; moderately acid (pH 6.0); clear wavy boundary.

C1—17 to 25 inches; dark brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; massive; soft, very friable, nonsticky and nonplastic; common fine roots; many fine irregular pores; 10 percent gravel; slightly acid (pH 6.2); gradual wavy boundary.

C2—25 to 30 inches; dark brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; massive; soft, very friable, nonsticky and nonplastic; common fine roots; many fine irregular pores; 10 percent gravel; slightly acid (pH 6.4); gradual wavy boundary.

C3—30 to 42 inches; dark brown (10YR 4/3) fine sand, pale brown (10YR 6/3) dry; single grain; loose, nonsticky and nonplastic; common fine roots; many fine irregular pores; 10 percent gravel; slightly acid (pH 6.2); clear wavy boundary.

C4—42 to 60 inches; dark grayish brown (10YR 4/2) loamy sand, pale brown (10YR 6/3) dry; single grain; loose, nonsticky and nonplastic; common irregular pores; 10 percent gravel and 4 percent cobbles; slightly acid (pH 6.2).

The depth to bedrock is 60 inches or more. The particle-size control section contains 5 to 15 percent clay. The mollic epipedon is 10 to 20 inches thick.

The A horizon has value of 2 or 3 moist, 4 or 5 dry, and chroma of 2 or 3 moist and dry. The C horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist and dry. It is dominantly sandy loam, fine sand, or loamy sand. In some pedons, however, it has gravelly or very gravelly layers below a depth of 40 inches.

Norling Series

The Norling series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from altered sedimentary and volcanic rock. Slopes are 35 to 55 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Norling very gravelly loam, in an area of Norling-Acker complex, 35 to 55 percent south slopes; about 2,200 feet west and 1,600 feet south of the northeast corner of sec. 2, T. 33 S., R. 4 W.

Oi—2 inches to 0; leaves, needles, twigs, and roots.

A1—0 to 5 inches; brown (10YR 4/3) very gravelly loam, brown (10YR 5/3) dry; strong fine granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine and fine, common medium, and few coarse roots; many very fine irregular pores; 45 percent gravel and 5 percent cobbles; strongly acid (pH 5.4); abrupt smooth boundary.

A2—5 to 10 inches; brown (10YR 4/3) gravelly clay loam, pale brown (10YR 6/3) dry; moderate very fine and fine subangular blocky structure; hard, friable, sticky and plastic; many very fine, fine, and medium and few coarse roots; many very fine tubular pores; 25 percent gravel and 5 percent cobbles; moderately acid (pH 5.6); clear wavy boundary.

Bt1—10 to 22 inches; yellowish brown (10YR 5/4) gravelly clay loam, light yellowish brown (10YR 6/4) dry; moderate very fine and fine subangular blocky structure; hard, friable, sticky and plastic; common very fine, fine, and medium roots; common very fine tubular pores; common faint clay films on faces of peds; 20 percent gravel and 5 percent cobbles; moderately acid (pH 5.6); clear wavy boundary.

Bt2—22 to 29 inches; yellowish brown (10YR 5/4) very cobbly clay loam, light yellowish brown (10YR 6/4) dry; moderate very fine and fine subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots; common very fine tubular pores; common faint clay films on faces of peds; 20 percent gravel and 20 percent cobbles; moderately acid (pH 5.6); clear wavy boundary.

Cr—29 inches; highly fractured metavolcanic rock.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 18 to 35 percent clay and 5 to 35 percent rock fragments.

The A horizon has hue of 10YR or 7.5YR; value of 2 to 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist, 3 or 4 dry. The Bt horizon has hue of 10YR or 7.5YR; value of 3 to 5 moist, 5 or 6 dry; and chroma of 3 to 6 moist and dry. It is gravelly clay loam, clay loam, or gravelly loam in the upper part and very cobbly clay loam, very gravelly clay loam, or very gravelly loam in the lower part.

Oatman Series

The Oatman series consists of very deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium and residuum derived from igneous rock and containing volcanic ash. Slopes are 0 to 65 percent. The mean annual precipitation is about 35 inches, and the mean annual temperature is about 42 degrees F.

Typical pedon of Oatman cobbly loam, in an area of Oatman-Otwin complex, 0 to 12 percent slopes, about 8 miles northeast of Hyatt Reservoir; about 300 feet south and 330 feet west of the northeast corner of sec. 26, T. 38 S., R. 4 E.

Oi—3 inches to 0; needles and twigs.

A—0 to 2 inches; dark brown (7.5YR 3/2) cobbly loam, dark brown (7.5YR 3/4) dry; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; 15 percent gravel and 10 percent cobbles; slightly acid (pH 6.5); abrupt smooth boundary.

AB—2 to 16 inches; dark brown (7.5YR 3/4) cobbly loam, dark brown (7.5YR 4/4) dry; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; 10 percent gravel and 15 percent cobbles; slightly acid (pH 6.5); clear smooth boundary.

Bw—16 to 30 inches; dark brown (7.5YR 3/4) very cobbly sandy loam, dark brown (7.5YR 4/4) dry; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common medium and coarse and many very fine and fine roots; many very fine irregular pores; 10 percent gravel and 30 percent cobbles; slightly acid (pH 6.3); gradual wavy boundary.

C1—30 to 42 inches; dark brown (7.5YR 3/4) very cobbly sandy loam, strong brown (7.5YR 4/6) dry; massive; soft, very friable, nonsticky and nonplastic; common medium and coarse and many very fine and fine roots; many very fine irregular pores; 10 percent gravel and 35 percent cobbles; slightly acid (pH 6.2); gradual wavy boundary.

C2—42 to 60 inches; dark brown (7.5YR 4/4) very cobbly sandy loam, brown (7.5YR 5/4) dry; massive; soft, very friable, nonsticky and nonplastic; few fine and medium roots; many very fine irregular pores; 15 percent gravel and 25 percent cobbles; moderately acid (pH 6.0).

The depth to bedrock is 60 inches or more. The particle-size control section contains 35 to 70 percent rock fragments and 15 to 27 percent clay.

The A horizon has hue of 10YR, 7.5YR, or 5YR; value of 3 or 4 moist, 3 to 5 dry; and chroma of 2 to 4 moist, 3 or 4 dry. The Bw horizon has hue of 10YR, 7.5YR, or 5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 3 or 4 moist and dry. It is very cobbly sandy loam, very gravelly loam, or extremely cobbly loam. The C horizon has hue of 10YR, 7.5YR, or 5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 3 or 4 moist, 3 to 6 dry. It has textures similar to those of the Bw horizon.

Offenbacher Series

The Offenbacher series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from altered sedimentary and volcanic rock. Slopes are 50 to 80 percent. The mean annual precipitation is about 32 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Offenbacher gravelly loam, in an area of Caris-Offenbacher gravelly loams, 50 to 80 percent north slopes, about 6 miles east of Ruch; about 900 feet north and 75 feet east of the southwest corner of sec. 26, T. 38 S., R. 2 W.

Oi—1 inch to 0; leaves, needles, and twigs.

A—0 to 4 inches; dark grayish brown (10YR 4/2) gravelly loam, light brownish gray (10YR 6/2) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many roots; many irregular pores; 15 percent gravel; slightly acid (pH 6.5); abrupt smooth boundary.

BAt—4 to 9 inches; dark brown (7.5YR 4/4) gravelly loam, light brownish gray (10YR 6/2) dry; moderate very fine and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many roots; many very fine tubular pores; few faint clay films on faces of peds; 15 percent gravel; slightly acid (pH 6.3); clear wavy boundary.

Bt1—9 to 21 inches; reddish brown (5YR 4/4) loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; many roots; many fine tubular pores; few faint clay films on faces of peds; 10 percent gravel; slightly acid (pH 6.2); gradual wavy boundary.

Bt2—21 to 28 inches; yellowish red (5YR 4/6) loam,

light brown (7.5YR 6/4) dry; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; common fine and medium roots; many fine tubular pores; few faint clay films on faces of peds; common black concretions 2 to 4 millimeters in diameter; slightly acid (pH 6.2); gradual wavy boundary.

Bt3—28 to 34 inches; yellowish red (5YR 4/6) loam, light brown (7.5YR 6/4) dry; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; common fine roots; many very fine and fine tubular pores; few faint clay films on faces of peds; 5 percent gravel; slightly acid (pH 6.2); abrupt smooth boundary.

R—34 inches; fractured, metamorphosed volcanic rock.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 5 to 35 percent rock fragments and 18 to 30 percent clay.

The A horizon has value of 3 or 4 moist, 4 to 6 dry, and chroma of 2 to 4 moist, 3 or 4 dry. The Bt horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 or 5 moist, 5 or 6 dry; and chroma of 4 to 6 moist, 3 to 5 dry. It is loam, clay loam, gravelly loam, or gravelly clay loam.

Otwin Series

The Otwin series consists of moderately deep, well drained soils on plateaus. These soils formed in colluvium and residuum derived from igneous rock and containing volcanic ash. Slopes are 0 to 12 percent. The mean annual precipitation is about 35 inches, and the mean annual temperature is about 42 degrees F.

Typical pedon of Otwin stony sandy loam, in an area of Oatman-Otwin complex, 0 to 12 percent slopes, about 3 miles west of Buck Lake; about 1,340 feet north and 2,592 feet west of the southeast corner of sec. 17, T. 38 S., R. 5 E.

Oi—1 inch to 0; needles and twigs.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) stony sandy loam, dark brown (10YR 4/3) dry; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many roots; many irregular pores; 15 percent gravel and 5 percent stones; slightly acid (pH 6.5); clear smooth boundary.

BA—3 to 13 inches; dark yellowish brown (10YR 3/4) very cobbly sandy loam, dark brown (7.5YR 4/4) dry; weak fine and medium granular structure; soft, very friable, nonsticky and nonplastic; many roots; many irregular pores; 15 percent gravel and 25 percent cobbles; slightly acid (pH 6.3); gradual smooth boundary.

Bw—13 to 28 inches; dark brown (7.5YR 3/4) very cobbly sandy loam, yellowish brown (10YR 5/4) dry; weak medium granular structure; appears massive when wet; soft, very friable, nonsticky and nonplastic; common roots; many irregular pores; 15 percent gravel and 25 percent cobbles; slightly acid (pH 6.1); abrupt irregular boundary.

R—28 inches; fractured andesite.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 60 percent rock fragments and 10 to 18 percent clay. It has a bulk density of 0.85 to 0.95 gram per cubic centimeter.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4 dry, and chroma of 2 to 4 moist, 3 or 4 dry. The Bw horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 4 or 5 dry; and chroma of 3 or 4 moist. It is very cobbly sandy loam or very cobbly loam.

Padigan Series

The Padigan series consists of very deep, poorly drained soils in basins. These soils formed in clayey alluvium derived from igneous rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Padigan clay, 0 to 3 percent slopes, about 2 miles north of Medford; about 1,950 feet east and 850 feet north of the southwest corner of sec. 32, T. 36 S., R. 1 W.

Ap—0 to 6 inches; very dark gray (N 3/0) clay, very dark gray (N 3/0) dry; strong fine and medium granular structure; extremely hard, firm, very sticky and very plastic; many very fine roots; many fine irregular pores; mildly alkaline (pH 7.4); abrupt smooth boundary.

A—6 to 12 inches; very dark gray (N 3/0) clay, very dark gray (N 3/0) dry; moderate very coarse prismatic structure; extremely hard, firm, very sticky and very plastic; common fine roots; many very fine irregular pores; mildly alkaline (pH 7.6); clear wavy boundary.

ABk1—12 to 25 inches; very dark gray (N 3/0) clay, very dark gray (N 3/0) dry; moderate very coarse prismatic structure parting to strong medium angular blocky; extremely hard, firm, very sticky and very plastic; many prominent intersecting slickensides; common fine roots; common very fine tubular pores; strongly effervescent; moderately alkaline (pH 8.0); gradual wavy boundary.

ABk2—25 to 36 inches; very dark grayish brown (2.5Y 3/2) clay, dark grayish brown (2.5Y 4/2) dry; moderate very coarse prismatic structure parting to strong medium angular blocky; extremely hard, firm,

very sticky and very plastic; many prominent intersecting slickensides; common fine distinct mottles; common fine roots; common very fine tubular pores; soft accumulations of light gray (10YR 7/2) carbonates that are violently effervescent; moderately alkaline (pH 8.4); clear wavy boundary.

Bk1—36 to 42 inches; grayish brown (2.5Y 5/2) clay, light gray (2.5Y 7/2) dry; massive; extremely hard, firm, very sticky and very plastic; many prominent intersecting slickensides; common fine distinct mottles; common fine roots; few very fine tubular pores; soft accumulations of light gray (10YR 7/2) carbonates that are violently effervescent; strongly alkaline (pH 8.6); clear wavy boundary.

2Bk2—42 to 60 inches; grayish brown (2.5Y 5/2) gravelly sandy clay loam, light gray (2.5Y 7/2) dry; massive; hard, friable, sticky and plastic; common fine distinct mottles; few fine roots; few fine irregular pores; 20 percent gravel; violently effervescent; moderately alkaline (pH 8.4).

The depth to bedrock is 60 inches or more. The soils are saturated to the surface for at least 1 month in most years. The particle-size control section contains 60 to 70 percent clay. The 2B horizon, if it occurs, is at a depth of more than 40 inches. It contains 15 to 25 percent gravel and 0 to 5 percent cobbles. In most years the soils have cracks that are open to the surface or to the base of a plow layer. These cracks are at least 1 centimeter wide at a depth of 20 inches. The soils have intersecting slickensides.

The A horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 2 or 3 moist, 3 or 4 dry, and chroma of 0 or 1 moist and dry. The AB and B horizons have hue of 2.5Y or 10YR or are neutral in hue. They have chroma of 0 or 1 in pedons that do not have distinct mottles and lime concretions. The chroma ranges to 3 in pedons where mottles are distinct.

Paragon Series

The Paragon series consists of moderately deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium and residuum derived from igneous rock. Slopes are 1 to 35 percent. The mean annual precipitation is about 23 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Paragon cobbly loam, in an area of Campfour-Paragon complex, 1 to 12 percent slopes; about 1,600 feet west and 2,450 feet north of the southeast corner of sec. 35, T. 40 S., R. 5 E.

Oi—1 inch to 0; needles and twigs.

A—0 to 3 inches; dark reddish brown (5YR 2/2) cobbly loam, brown (7.5YR 4/4) dry; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine irregular pores; 5 percent gravel and 10 percent cobbles; strongly acid (pH 5.4); clear smooth boundary.

AB—3 to 13 inches; dark reddish brown (5YR 3/3) cobbly loam, brown (7.5YR 4/4) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine tubular pores; 5 percent gravel and 10 percent cobbles; moderately acid (pH 5.8); clear wavy boundary.

Bt—13 to 25 inches; dark reddish brown (5YR 3/3) gravelly clay loam, brown (7.5YR 4/4) dry; moderate very fine and fine angular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and few fine, medium, and coarse roots; common very fine tubular pores; common faint clay films on faces of peds; 10 percent hard gravel and 5 percent hard cobbles; 50 percent soft andesite fragments; moderately acid (pH 6.0); clear wavy boundary.

Cr—25 inches; weathered andesite.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 27 to 35 percent clay, 10 to 35 percent hard rock fragments, and 25 to 65 percent soft rock fragments. The mollic epipedon is 20 to 40 inches thick.

The A horizon has hue of 7.5YR or 5YR; value of 2 or 3 moist, 3 or 4 dry; and chroma of 2 or 3 moist, 3 or 4 dry. The Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5 dry, and chroma of 3 or 4 moist, 4 or 5 dry. It is clay loam, cobbly clay loam, or gravelly clay loam.

Pearsoll Series

The Pearsoll series consists of shallow, well drained soils on hillslopes. These soils formed in colluvium derived from serpentinitic rock. Slopes are 20 to 60 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Pearsoll extremely stony clay loam, in an area of Pearsoll-Dubakella complex, rocky, 20 to 60 percent slopes, about 13 miles north of Wimer; about 1,000 feet west and 1,500 feet south of the northeast corner of sec. 4, T. 33 S., R. 4 W.

Oi—½ inch to 0; leaves, needles, and twigs.

A—0 to 7 inches; dark brown (7.5YR 3/2) extremely stony clay loam, brown (7.5YR 4/4) dry; strong fine granular structure; slightly hard, friable, sticky and

plastic; many very fine and common fine, medium, and coarse roots; common irregular pores; 15 percent gravel and 5 percent cobbles; stones covering 40 percent of the surface; slightly acid (pH 6.1); abrupt smooth boundary.

Bt1—7 to 15 inches; dark brown (7.5YR 3/4) very cobbly clay, brown (7.5YR 4/4) dry; moderate fine angular blocky structure; hard, friable, sticky and plastic; common very fine, fine, medium, and coarse roots; common fine and very fine tubular pores; few faint clay films on faces of peds; 15 percent gravel and 20 percent cobbles; slightly acid (pH 6.1); abrupt wavy boundary.

Bt2—15 to 19 inches; dark brown (7.5YR 3/4) extremely cobbly clay, brown (7.5YR 5/4) dry; moderate fine angular blocky structure; hard, friable, sticky and plastic; few very fine, fine, and medium roots; common fine and very fine tubular pores; few faint clay films on faces of peds; 20 percent gravel and 50 percent cobbles; moderately acid (pH 6.1); abrupt irregular boundary.

R—19 inches; serpentinite.

The depth to bedrock is 10 to 20 inches. The particle-size control section contains 35 to 70 percent rock fragments and 40 to 60 percent clay.

The A horizon has hue of 5YR or 7.5YR, value of 3 or 4 dry, and chroma of 2 or 3 moist, 3 or 4 dry. The Bt horizon has hue of 7.5YR, 5YR, or 2.5YR; value of 4 or 5 dry; and chroma of 4 to 6 moist and dry.

Phoenix Series

The Phoenix series consists of moderately deep, poorly drained soils on alluvial fans. These soils formed in alluvium and colluvium derived from igneous rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Phoenix clay, 0 to 3 percent slopes, about 4 miles east of Central Point, about 750 feet east of Sticky Lane and 200 feet south of a field road; about 2,400 feet north and 750 feet east of the southwest corner of sec. 33, T. 36 S., R. 1 W.

Ap—0 to 3 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3.5/1) dry; strong fine granular structure; extremely hard, firm, very sticky and very plastic; common very fine and fine roots; many irregular pores; slightly acid (pH 6.4); abrupt smooth boundary.

A—3 to 20 inches; dark gray (10YR 4/1) clay, dark gray (10YR 4/1) dry; massive or cloddy in the upper 4 inches and moderate coarse and medium angular blocky structure in the lower part; extremely hard, firm, very sticky and very plastic; many intersecting slickensides; common very fine and fine roots; common very fine tubular pores; slightly acid (pH 6.4); diffuse smooth boundary.

Bw1—20 to 33 inches; dark gray (N 4/0) clay, dark gray (N 4/0) dry; moderate coarse and medium angular blocky structure; many intersecting slickensides; extremely hard, firm, very sticky and very plastic; common fine roots; common very fine tubular pores; neutral (pH 7.2); clear smooth boundary.

Bw2—33 to 40 inches; gray (2.5Y 5/1) clay, gray (2.5Y 5/1) dry; moderate coarse and medium angular blocky structure; many intersecting slickensides; extremely hard, firm, very sticky and very plastic; common fine roots; common very fine tubular pores; mildly alkaline (pH 7.4); abrupt smooth boundary.

2Cr—40 inches; decomposed sandstone.

The depth to bedrock is 20 to 40 inches. The soils are saturated to the surface for at least 1 month in most years. The particle-size control section contains 60 to 70 percent clay. In most years the soils have cracks that are open to the surface or to the base of a plow layer. These cracks are at least 1 centimeter wide at a depth of 20 inches. The soils have intersecting slickensides.

The Ap and A horizons have hue of 10YR or 2.5Y, value of 3.5 or 4 moist and dry, and chroma of 1 moist, 1 or 2 dry. The Bw horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 4 or 5 moist and dry and chroma of 0 to 2 moist and dry.

Pinehurst Series

The Pinehurst series consists of very deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium derived from igneous rock. Slopes are 1 to 35 percent. The mean annual precipitation is about 35 inches, and the mean annual temperature is about 44 degrees F.

Typical pedon of Pinehurst loam, 3 to 12 percent slopes, about 0.75 mile east of Hyatt Lake; about 600 feet north and 500 feet west of the southeast corner of sec. 11, T. 39 S., R. 3 E.

Oi—1 inch to 0; needles and twigs.

A1—0 to 4 inches; dark reddish brown (5YR 2/2) loam, dark brown (7.5YR 3/3) dry; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many irregular pores; 10 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

A2—4 to 15 inches; dark reddish brown (5YR 2/2) loam, very dark grayish brown (10YR 3/2) crushed, dark reddish brown (5YR 3/3) dry; moderate very fine

subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and coarse roots; many very fine tubular pores; 10 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

BAt—15 to 21 inches; dark reddish brown (5YR 3/3) clay loam, reddish brown (5YR 4/3) dry; moderate very fine and fine subangular blocky structure; hard, friable, sticky and plastic; common fine and coarse roots; many very fine tubular pores; few faint clay films; 10 percent gravel; moderately acid (pH 6.0); clear wavy boundary.

Bt—21 to 41 inches; dark reddish brown (5YR 3/4) clay loam, reddish brown (5YR 4/4) rubbed, dark brown (7.5YR 4/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few medium and coarse roots; many very fine tubular pores; common faint clay films; 10 percent partially weathered gravel; moderately acid (pH 5.8); gradual wavy boundary.

BCt—41 to 60 inches; dark reddish brown (5YR 3/4) clay loam, brown (7.5YR 5/4) dry; weak coarse subangular blocky structure; hard, friable, sticky and plastic; few medium roots; common very fine tubular pores; few faint clay films; 5 percent partially weathered gravel and 10 percent partially weathered cobbles; strongly acid (pH 5.4).

The depth to bedrock is 60 inches or more. The particle-size control section contains 20 to 35 percent clay and 5 to 35 percent partially weathered rock fragments. The mollic epipedon is 20 to 30 inches thick.

The A horizon has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3 moist, 3 to 5 dry; and chroma of 2 or 3 moist, 2 to 4 dry. The Bt horizon has hue of 10YR, 7.5YR, or 5YR; value of 3 to 5 moist, 4 to 6 dry; and chroma of 2 to 4 moist and dry. It is loam, clay loam, gravelly clay loam, or cobbly clay loam.

Pokegema Series

The Pokegema series consists of deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium and residuum derived from igneous rock. Slopes are 1 to 35 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Pokegema loam, in an area of Pokegema-Woodcock complex, 1 to 12 percent slopes, about 10 miles east of Pinehurst; about 35 feet south of the northeast corner of sec. 1, T. 40 S., R. 5 E.

Oi—½ inch to 0; needles, leaves, and twigs.

A1—0 to 2 inches; dark reddish brown (5YR 2/2) loam, dark brown (7.5YR 4/2) dry; weak very fine granular structure; very soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine pores; slightly acid (pH 6.5); abrupt smooth boundary.

A2—2 to 8 inches; dark reddish brown (5YR 3/3) loam, reddish brown (5YR 4/3) dry; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and coarse roots; many very fine tubular pores; slightly acid (pH 6.5); gradual wavy boundary.

BA—8 to 16 inches; dark reddish brown (5YR 3/3) clay loam, reddish brown (5YR 5/3) dry; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, sticky and slightly plastic; many fine and coarse roots; many very fine tubular pores; slightly acid (pH 6.4); clear smooth boundary.

Bw1—16 to 26 inches; dark reddish brown (5YR 3/3) gravelly clay, reddish brown (5YR 5/3) dry; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; many fine and few coarse roots; many very fine tubular pores; 15 percent gravel (mainly at a depth of 24 to 26 inches); slightly acid (pH 6.3); gradual smooth boundary.

2Bw2—26 to 38 inches; dark reddish brown (5YR 3/3) gravelly clay, brown (7.5YR 5/3) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine and coarse roots; many very fine tubular pores; 15 percent gravel and 5 percent cobbles; slightly acid (pH 6.1); clear wavy boundary.

2C—38 to 52 inches; dark reddish brown (5YR 3/3) and reddish brown (5YR 4/4) gravelly clay, reddish brown (5YR 4/3) dry; massive; firm, sticky and plastic; few fine and coarse roots; common very fine tubular pores; 15 percent gravel and 5 percent cobbles; moderately acid (pH 5.8); abrupt wavy boundary.

3Cr—52 inches; partially weathered andesite.

The depth to bedrock is 40 to 60 inches. The particle-size control section contains 35 to 55 percent clay and 5 to 35 percent rock fragments. The mollic epipedon is 16 to 32 inches thick.

The A horizon has hue of 7.5YR, 5YR, or 2.5YR; value of 2 or 3 moist, 4 dry; and chroma of 2 to 4 moist and dry. The 2Bw and 2C horizons have hue of 7.5YR, 5YR, or 2.5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist, 2 to 6 dry. They are clay, gravelly clay loam, or gravelly clay.

Pollard Series

The Pollard series consists of very deep, well drained soils on alluvial fans and hillslopes. These soils formed

in alluvium and colluvium derived from altered sedimentary and volcanic rock. Slopes are 2 to 35 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Pollard loam, in an area of Josephine-Pollard complex, 12 to 35 percent south slopes; about 1,600 feet west and 500 feet north of the southeast corner of sec. 3, T. 34 S., R. 3 W.

Oi—2 inches to 0; leaves, twigs, needles, cones, and grass.

A1—0 to 3 inches; dark brown (7.5YR 3/3) loam, brown (7.5YR 4/4) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine, medium, and coarse irregular pores; 10 percent gravel; moderately acid (pH 5.6); abrupt smooth boundary.

A2—3 to 11 inches; dark brown (7.5YR 3/4) loam, brown (7.5YR 4/4) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many irregular pores; 10 percent gravel; moderately acid (pH 5.6); clear smooth boundary.

AB—11 to 18 inches; dark reddish brown (5YR 3/4) clay loam, reddish brown (5YR 4/4) dry; strong fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine and very fine and few medium roots; common tubular pores; 10 percent gravel; moderately acid (pH 5.6); clear smooth boundary.

Bt1—18 to 36 inches; dark reddish brown (5YR 3/4) clay loam, reddish brown (5YR 4/4) dry; strong medium and coarse subangular blocky structure; hard, very firm, sticky and plastic; few very fine, fine, medium, and coarse roots; few tubular pores; common faint and many distinct clay films; 10 percent gravel; moderately acid (pH 5.6); gradual smooth boundary.

Bt2—36 to 45 inches; yellowish red (5YR 4/6) clay loam, reddish brown (5YR 5/4) dry; moderate medium and coarse subangular blocky structure; hard, very firm, sticky and plastic; few very fine and coarse roots; few tubular pores; common faint and many distinct clay films; 10 percent gravel; moderately acid (pH 5.6); gradual wavy boundary.

BCt—45 to 61 inches; brown (7.5YR 4/4) clay loam, brown (7.5YR 5/4) dry; weak medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few medium and coarse roots; few tubular pores; many distinct clay films; 15 percent soft gravel; strongly acid (pH 5.4).

The depth to bedrock is 60 inches or more. The particle-size control section contains 35 to 50 percent clay.

The A horizon has hue of 7.5YR, 5YR, or 2.5YR; value of 3 or 4 moist, 4 or 5 dry; and chroma of 3 or 4 moist, 3 to 6 dry. The Bt horizon has hue of 2.5YR or 5YR, value of 3 or 4 moist (4 or 5 dry in the upper part and 5 dry in the lower part), and chroma of 4 to 6 moist and dry. It is clay, silty clay, or clay loam. Some pedons have as much as 50 percent rock fragments in the BCt horizon or below the control section.

Provig Series

The Provig series consists of very deep, well drained soils on dissected fan terraces. These soils formed in stratified alluvium. Slopes are 5 to 35 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Provig very gravelly loam, in an area of Provig-Agate complex, 5 to 15 percent slopes, about 3.5 miles north of Central Point; about 2,000 feet west and 2,320 feet north of the southeast corner of sec. 21, T. 36 S., R. 2 W.

Oi—1 inch to 0; leaves.

A1—0 to 3 inches; very dark brown (10YR 2/2) very gravelly loam, very dark grayish brown (10YR 3/2) dry; moderate fine subangular blocky structure parting to moderate very fine granular; soft, very friable, slightly sticky and nonplastic; many fine and very fine roots; many fine irregular pores; 35 percent gravel; slightly acid (pH 6.1); clear smooth boundary.

A2—3 to 9 inches; very dark grayish brown (10YR 3/2) very gravelly loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; many very fine tubular pores; 50 percent gravel and 5 percent cobbles; neutral (pH 6.6); clear smooth boundary.

Bt—9 to 15 inches; dark brown (7.5YR 3/2) very gravelly clay loam, dark brown (10YR 3/3) crushed, brown (7.5YR 4/2) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; many very fine tubular pores; common distinct clay films on faces of peds and in pores; common clay bridges; 45 percent gravel and 5 percent cobbles; neutral (pH 6.6); abrupt smooth boundary.

2C—15 to 60 inches; variegated dark reddish brown (5YR 3/3, 3/4) and reddish brown (5YR 4/4, 5/4) extremely gravelly clay that has lenses of coarser textured material; massive; very hard, firm, very sticky and very plastic; common black stains; 70

percent gravel and 5 percent cobbles; neutral (pH 6.8).

The depth to bedrock is 60 inches or more. The thickness of the solum and depth to the 2C horizon are 14 to 20 inches. The particle-size control section contains 35 to 45 percent clay and 35 to 60 percent rock fragments.

The A horizon has hue of 10YR or 7.5YR; value of 2 or 3 moist, 3 or 4 dry; and chroma of 2 or 3 moist and dry. The Bt horizon has value of 4 or 5 dry and chroma of 2 or 3 moist and dry. It is very gravelly clay loam or very gravelly clay. The 2C horizon has variegated colors. It is extremely gravelly clay or extremely gravelly clay loam and contains 60 to 90 percent rock fragments.

Randcore Series

The Randcore series consists of very shallow, moderately well drained soils on plateaus. These soils are between mounds in areas of patterned ground. They formed in loess over igneous rock. Slopes are 0 to 5 percent. The mean annual precipitation is about 22 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Randcore extremely stony loam, in an area of Randcore-Shoat complex, 0 to 5 percent slopes, about 1 mile east of the intersection of Copco Road and the Oregon-California State line; about 100 feet west of the southeast corner of sec. 10, T. 41 S., R. 4 E.

A1—0 to 1 inch; dark brown (7.5YR 3/4) extremely stony loam, brown (7.5YR 5/4) dry; weak medium platy structure; soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine vesicular pores; 60 percent stones and 5 percent gravel; slightly acid (pH 6.4); abrupt smooth boundary.

A2—1 to 6 inches; dark brown (7.5YR 3/4) loam, brown (7.5YR 5/4) dry; weak very fine and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine and fine irregular and few tubular and vesicular pores; 5 percent gravel; slightly acid (pH 6.5); abrupt wavy boundary.

2R—6 inches; andesite.

The depth to bedrock is 4 to 10 inches. The soils are saturated to the surface for at least 1 month in most years. The particle-size control section contains 50 to 85 percent rock fragments and 12 to 25 percent clay.

The A horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 3 or 4 moist and dry. It is silt loam or loam in the lower part.

Reinecke Series

The Reinecke series consists of very deep, well drained soils on plateaus. These soils formed in volcanic ash over residuum weathered from igneous rock. Slopes are 0 to 5 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Reinecke sandy loam, in an area of Reinecke-Coyata complex, 0 to 5 percent slopes, about 4 miles east of Prospect; about 2,275 feet east and 775 feet south of the northwest corner of sec. 25, T. 32 S., R. 3 E.

Oi—2 inches to 0; needles and twigs.

A1—0 to 3 inches; dark brown (7.5YR 3/2) sandy loam, brown (10YR 4/3) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and common medium and coarse roots; many very fine irregular pores; 10 percent gravel-sized pumice; slightly acid (pH 6.4); abrupt smooth boundary.

A2—3 to 9 inches; dark brown (7.5YR 3/4) sandy loam, brown (7.5YR 4/4) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; many very fine irregular pores; 10 percent gravel-sized pumice; moderately acid (pH 6.0); abrupt wavy boundary.

Bw—9 to 25 inches; brown (7.5YR 4/4) gravelly sandy loam, brown (7.5YR 5/4) dry; weak very fine and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; many very fine irregular pores; 20 percent gravel-sized pumice; moderately acid (pH 5.6); abrupt wavy boundary.

2ABb—25 to 33 inches; dark reddish brown (5YR 3/3) loam, brown (7.5YR 5/4) dry; weak fine and medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common roots; common very fine tubular pores; strongly acid (pH 5.2); clear wavy boundary.

2Bwb—33 to 60 inches; dark reddish brown (5YR 3/3) cobbly loam, brown (5YR 5/4) dry; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few roots; common very fine tubular pores; 5 percent gravel and 20 percent cobbles; moderately acid (pH 5.6).

The depth to bedrock is 60 inches or more. The bulk density of the ash mantle is 0.75 to 0.90 gram per cubic

centimeter. The thickness of the ash mantle and depth to the buried soil are 20 to 40 inches.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5 dry, and chroma of 2 to 4 moist and dry. The Bw horizon has hue of 7.5YR or 10YR, value of 5 or 6 dry, and chroma of 4 to 6 moist and dry. It is sandy loam or gravelly sandy loam. The 2AB horizon, if it occurs, has hue of 7.5YR or 5YR, value of 4 or 5 dry, and chroma of 3 or 4 moist and dry. It is loam that contains 10 to 20 percent clay and 0 to 15 percent rock fragments. The 2Bw horizon has hue of 7.5YR, 5YR, or 2.5YR; value of 4 or 5 dry; and chroma of 3 or 4 moist, 3 to 6 dry. It is loam or clay loam in the fine-earth fraction and contains 25 to 35 percent clay and 5 to 35 percent rock fragments.

Rogue Series

The Rogue series consists of deep, somewhat excessively drained soils on hillslopes. These soils formed in colluvium derived from granitic rock. Slopes are 12 to 80 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Rogue cobbly coarse sandy loam, 35 to 75 percent south slopes; about 1,620 feet east and 40 feet south of the northwest corner of sec. 18, T. 40 S., R. 2 E.

A—0 to 6 inches; very dark grayish brown (10YR 3/2) cobbly coarse sandy loam, brown (10YR 5/3) dry; weak fine granular structure; loose, very friable, nonsticky and nonplastic; many fine and very fine roots; few fine irregular pores; 15 percent gravel and 15 percent cobbles; neutral (pH 6.8); abrupt smooth boundary.

Bw1—6 to 17 inches; brown (10YR 4/3) cobbly coarse sandy loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; many very fine irregular pores; 10 percent gravel and 20 percent cobbles; neutral (pH 6.7); clear smooth boundary.

Bw2—17 to 34 inches; yellowish brown (10YR 5/4) cobbly coarse sandy loam, pale brown (10YR 6/3) dry; massive; slightly hard, friable, nonsticky and nonplastic; many fine and medium and few coarse roots; many very fine irregular pores; 10 percent gravel and 20 percent cobbles; slightly acid (pH 6.4); clear wavy boundary.

C1—34 to 48 inches; light olive brown (2.5Y 5/4) coarse sandy loam, pale yellow (10YR 7/3) dry; massive; hard, friable, nonsticky and nonplastic; few medium and coarse roots; many very fine irregular pores; moderately acid (pH 6.0); clear wavy boundary.

C2—48 to 54 inches; light yellowish brown (2.5Y 6/4) coarse sandy loam, very pale brown (10YR 8/3) dry; massive; hard, friable, nonsticky and nonplastic; few very fine irregular pores; moderately acid (pH 5.8); gradual wavy boundary.

Cr—54 inches; weathered granodiorite.

The depth to bedrock is 40 to 60 inches. The particle-size control section contains 15 to 35 percent rock fragments and 5 to 15 percent clay.

The A horizon has value of 3 or 4 moist, 4 to 6 dry, and chroma of 2 to 4 moist and dry. The Bw horizon has hue of 10YR or 2.5Y; value of 4 or 5 moist, 5 or 6 dry; and chroma of 3 or 4 moist and dry. It is cobbly or gravelly coarse sandy loam. The C horizon has hue of 10YR or 2.5Y; value of 4 to 6 moist, 5 to 8 dry; and chroma of 2 to 4 moist and dry. It is coarse sandy loam, gravelly loamy coarse sand, or gravelly coarse sandy loam.

Royst Series

The Royst series consists of moderately deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium and residuum derived igneous rock and containing small amounts of volcanic ash. Slopes are 1 to 35 percent. The mean annual precipitation is about 20 inches, and the mean annual temperature is about 44 degrees F.

Typical pedon of Royst gravelly loam, in an area of Bly-Royst complex, 1 to 12 percent slopes, about 3 miles south of Round Lake; about 1,825 feet west and 2,025 feet north of the southeast corner of sec. 25, T. 39 S., R. 7 E.

Oi—1 inch to 0; needles and twigs.

A—0 to 4 inches; dark reddish brown (5YR 2.5/2) gravelly loam, reddish brown (5YR 4/3) dry; moderate very fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium and few coarse roots; many very fine pores; 15 percent gravel and 5 percent cobbles; strongly acid (pH 5.4); abrupt smooth boundary.

AB—4 to 11 inches; dark reddish brown (5YR 3/2) gravelly loam, brown (7.5YR 4/4) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium and few coarse roots; common very fine tubular pores; 15 percent gravel and 5 percent cobbles; moderately acid (pH 5.8); abrupt wavy boundary.

Bt—11 to 21 inches; dark reddish brown (5YR 3/3) very cobbly clay loam, brown (7.5YR 4/4) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly

plastic; few very fine and fine roots; common very fine tubular pores; few faint clay films on faces of peds; 25 percent gravel and 30 percent cobbles; moderately acid (pH 5.8); clear wavy boundary.

2Cr—21 to 23 inches; decomposed andesite.

2R—23 inches; andesite.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 27 to 35 percent clay and 35 to 60 percent rock fragments. The mollic epipedon is 20 to 30 inches thick.

The A horizon has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3 moist, 4 or 5 dry; and chroma of 2 or 3 moist, 3 or 4 dry. The Bt horizon has hue of 10YR, 7.5YR, or 5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist and dry. It is very gravelly or very cobbly clay loam.

The Royst soils in this survey area are taxadjuncts to the series because they have 27 to 35 percent clay in the particle-size control section rather than 35 to 45 percent. This difference, however, does not significantly affect the use and management of the soils.

Ruch Series

The Ruch series consists of very deep, well drained soils on foot slopes and alluvial fans. These soils formed in mixed alluvium derived from altered sedimentary and volcanic rock. Slopes are 2 to 20 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 52 degrees F.

Typical pedon of Ruch gravelly silt loam, 7 to 20 percent slopes, about 2 miles north of Ruch; about 520 feet west and 540 feet south of the northeast corner of sec. 15, T. 38 S., R. 3 W.

A1—0 to 2 inches; dark brown (7.5YR 3/3) gravelly silt loam, brown (10YR 5/3) dry; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine irregular pores; 20 percent gravel; slightly acid (pH 6.3); abrupt smooth boundary.

A2—2 to 7 inches; dark brown (7.5YR 4/4) gravelly silt loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure parting to moderate very fine granular; hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine tubular and irregular pores; 20 percent gravel; slightly acid (pH 6.1); clear smooth boundary.

BAt—7 to 17 inches; reddish brown (5YR 4/4) loam, light brown (7.5YR 6/4) dry; weak medium subangular blocky structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; many fine roots; many very fine tubular pores; few faint red (2.5YR 4/6) clay films in pores; 10 percent gravel; common black concretions 2 to 4 millimeters in diameter; moderately acid (pH 5.8); clear wavy boundary.

Bt1—17 to 26 inches; yellowish red (5YR 4/6) loam, yellowish red (5YR 5/6) dry; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; common fine roots; many very fine tubular pores; common distinct red (2.5YR 4/6) clay films on faces of peds; common black concretions 2 to 4 millimeters in diameter; few black stains; 10 percent partially weathered gravel; moderately acid (pH 5.8); gradual wavy boundary.

Bt2—26 to 46 inches; yellowish red (5YR 4/6) loam, yellowish red (5YR 5/6) dry; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; many very fine tubular pores; common distinct red (2.5YR 4/6) clay films on faces of peds; common black concretions 2 to 4 millimeters in diameter; few black stains; 5 percent partially weathered gravel; moderately acid (pH 6.0); gradual wavy boundary.

Bt3—46 to 70 inches; yellowish red (5YR 4/6) loam, yellowish red (5YR 5/6) dry; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; many very fine tubular pores; common distinct red (2.5YR 4/6) clay films on faces of peds; common black concretions 2 to 4 millimeters in diameter; 10 percent partially weathered gravel; slightly acid (pH 6.1).

The depth to bedrock is 60 inches or more. The particle-size control section contains 25 to 35 percent clay and 5 to 20 percent rock fragments.

The A horizon has hue of 7.5YR or 10YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist and dry. It is silt loam or gravelly silt loam. The Bt horizon has hue of 5YR or 7.5YR; value of 3 or 4 moist, 5 or 6 dry; and chroma of 4 to 6 moist and dry. It is loam, clay loam, gravelly loam, or gravelly clay loam.

Rustlerpeak Series

The Rustlerpeak series consists of moderately deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium derived from igneous rock and volcanic ash. Slopes are 3 to 70 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Rustlerpeak gravelly loam, 12 to 35 percent north slopes; about 2,150 feet west and 2,100 feet south of the northeast corner of sec. 29, T. 38 S., R. 3 E.

Oi—1 inch to 0; needles, leaves, and twigs.

A1—0 to 6 inches; dark reddish brown (5YR 2.5/2) gravelly loam, dark reddish brown (5YR 3/2) dry; strong very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; common very fine and fine irregular pores; 10 percent gravel and 5 percent cobbles; slightly acid (pH 6.4); abrupt smooth boundary.

A2—6 to 12 inches; dark reddish brown (5YR 3/2) gravelly loam, reddish brown (5YR 4/3) dry; moderate fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; common very fine and fine irregular pores; 15 percent gravel and 5 percent cobbles; slightly acid (pH 6.2); clear smooth boundary.

Bw—12 to 23 inches; dark reddish brown (5YR 3/3) very cobbly clay loam, reddish brown (5YR 4/3) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; few very fine and fine irregular pores; 25 percent gravel and 15 percent cobbles; slightly acid (pH 6.2); clear wavy boundary.

Cr—23 inches; decomposed andesite.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 70 percent rock fragments and 20 to 35 percent clay. The umbric epipedon is 10 to 20 inches thick.

The A horizon has hue of 5YR or 7.5YR; value of 2 or 3 moist, 3 to 5 dry; and chroma of 2 or 3 moist, 2 to 4 dry. It has a bulk density of 0.85 to 0.95 gram per cubic centimeter. The Bw horizon has hue of 5YR or 7.5YR; value of 3 or 4 moist, 4 or 5 dry; and chroma of 2 or 3 moist, 2 to 4 dry. It is very cobbly clay loam, very cobbly loam, very gravelly loam, or extremely gravelly clay loam.

Selmac Series

The Selmac series consists of very deep, moderately well drained soils in basins. These soils formed in loamy and clayey alluvium. Slopes are 2 to 20 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 52 degrees F.

Typical pedon of Selmac loam, 7 to 20 percent slopes, about 6 miles southeast of the city of Rogue River; about 1,850 feet north and 975 feet east of the southwest corner of sec. 13, T. 37 S., R. 4 W.

A—0 to 4 inches; dark brown (7.5YR 3/2) loam, brown (7.5YR 5/2) dry; weak medium subangular blocky structure parting to moderate very fine granular; soft, friable, slightly sticky and slightly plastic; many very fine roots; many very fine vesicular and tubular pores; 10 percent gravel; moderately acid (pH 5.7); abrupt smooth boundary.

AB—4 to 17 inches; dark brown (7.5YR 3/4) loam, brown (7.5YR 5/4) dry; dark brown (7.5YR 3/2) coatings; weak medium subangular blocky structure parting to moderate very fine granular; soft, friable, slightly sticky and slightly plastic; common very fine roots; many very fine vesicular and tubular pores; 10 percent gravel; moderately acid (pH 5.6); clear smooth boundary.

Bt—17 to 29 inches; reddish brown (5YR 4/4) clay loam, reddish brown (5YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and medium roots; common fine and many very fine tubular pores; few distinct and common faint dark reddish brown (5YR 3/4) clay films on faces of peds; 5 percent gravel; moderately acid (pH 5.9); abrupt smooth boundary.

2C—29 to 60 inches; olive brown (2.5Y 4/4) clay, light yellowish brown (2.5Y 6/4) dry; massive; extremely hard, extremely firm, very sticky and very plastic; few coarse roots; few fine tubular pores; common fine to coarse slickensides and few intersecting slickensides; slightly acid (pH 6.1).

The depth to bedrock is 60 inches or more. The upper part of the particle-size control section contains 27 to 35 percent clay, and the lower part contains 55 to 70 percent clay. Depth to the clayey substratum is 12 to 36 inches.

The A horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 4 or 5 dry; and chroma of 2 to 4 moist, 3 or 4 dry. The Bt horizon has hue of 10YR, 7.5YR, or 5YR; value of 3 or 4 moist, 4 or 5 dry; and chroma of 3 or 4 moist and dry. It is clay loam or gravelly clay loam. A stone line is at the base of the solum in some pedons. The 2C horizon has hue of 2.5Y or 5Y; value of 4 or 5 moist, 6 or 7 dry; and chroma of 2 to 4 moist and dry.

Sevenoaks Series

The Sevenoaks series consists of very deep, somewhat excessively drained soils on stream terraces. These soils formed in alluvium derived from pumice and igneous rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 22 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Sevenoaks loamy sand, 0 to 3 percent slopes, about 1 mile south of Upper Table

Rock; about 1,800 feet west and 220 feet south of the northeast corner of sec. 15, T. 36 S., R. 2 W.

Ap1—0 to 7 inches; very dark brown (10YR 2/2) loamy sand, dark grayish brown (10YR 4/2) dry; weak medium and coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; very few fine roots; many fine irregular pores; 10 percent fine pumice gravel; moderately acid (pH 6.0); abrupt smooth boundary.

Ap2—7 to 14 inches; very dark brown (10YR 2/2) loamy sand, dark grayish brown (10YR 4/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; very few fine roots; many fine irregular pores; 10 percent fine pumice gravel; moderately acid (pH 6.0); clear smooth boundary.

AC—14 to 22 inches; dark brown (10YR 3/3) gravelly sand, brown (10YR 5/3) dry; single grain; loose, very friable, nonsticky and nonplastic; very few fine roots; many fine irregular pores; 15 percent pumice gravel; slightly acid (pH 6.4); gradual wavy boundary.

C1—22 to 54 inches; olive brown (2.5Y 3/3) gravelly coarse sand, light olive brown (2.5Y 5/3) dry; single grain; loose, nonsticky and nonplastic; very few fine roots; many fine irregular pores; 20 percent fine pumice gravel; slightly acid (pH 6.4); clear wavy boundary.

C2—54 to 60 inches; dark grayish brown (2.5Y 4/2) gravelly sand, grayish brown (2.5Y 5/2) dry; single grain; loose, nonsticky and nonplastic; many fine irregular pores; 20 percent fine pumice gravel; slightly acid (pH 6.4).

The depth to bedrock is 60 inches or more. The particle-size control section is sand or loamy sand and contains 15 to 30 percent gravel and less than 5 percent clay.

The A horizon has value of 2 or 3 moist, 4 or 5 dry, and chroma of 2 or 3 moist and dry. The AC and C horizons have hue of 10YR or 2.5Y; value of 3 or 4 moist, 5 or 6 dry; and chroma of 2 or 3 moist and dry. They are gravelly sand, gravelly coarse sand, or gravelly loamy sand.

Shefflein Series

The Shefflein series consists of deep, well drained soils on alluvial fans and hillslopes. These soils formed in alluvium, colluvium, and residuum derived from granitic rock. Slopes are 2 to 35 percent. The mean annual precipitation is about 32 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Shefflein loam, 20 to 35 percent south slopes, about 8 miles southeast of Ruch; about 725 feet south and 1,850 feet east of the northwest corner of sec. 31, T. 39 S., R. 2 W.

A—0 to 4 inches; dark brown (7.5YR 3/2) loam, brown (10YR 5/3) dry; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine irregular pores; moderately acid (pH 6.0); clear wavy boundary.

BA—4 to 10 inches; reddish brown (5YR 4/4) loam, light brown (7.5YR 6/4) dry; moderate fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; few medium and common very fine and fine roots; few very fine tubular pores; moderately acid (pH 6.0); clear wavy boundary.

Bt1—10 to 19 inches; reddish brown (5YR 4/4) clay loam, reddish brown (5YR 5/4) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine and few medium roots; few very fine tubular pores; few distinct clay films on faces of peds and in pores; moderately acid (pH 6.0); clear wavy boundary.

Bt2—19 to 40 inches; reddish brown (5YR 4/4) clay loam, reddish brown (5YR 5/4) dry; strong medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; common very fine and fine and few medium roots; common fine tubular pores; common distinct clay films on faces of peds and in pores; 5 percent gravel; slightly acid (pH 6.3); gradual wavy boundary.

Bt3—40 to 56 inches; reddish brown (5YR 4/4) sandy clay loam, reddish brown (5YR 5/4) dry; moderate medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; common fine tubular pores; common distinct clay films on faces of peds and in pores; 5 percent gravel; slightly acid (pH 6.3); diffuse wavy boundary.

Cr—56 inches; decomposed granitic rock.

The depth to bedrock is 40 to 60 inches. The particle-size control section contains 20 to 35 percent clay.

The A horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 5 or 6 dry; and chroma of 2 to 4 moist and dry. The Bt horizon has hue of 10YR, 5YR, or 7.5YR; value of 3 to 5 moist, 5 to 7 dry; and chroma of 3 to 6 moist and dry. It is clay loam, loam, or sandy clay loam.

Shippa Series

The Shippa series consists of shallow, well drained soils on hillslopes. These soils formed in colluvium derived from igneous rock. Slopes are 35 to 70 percent.

The mean annual precipitation is about 45 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Shippa extremely gravelly loam, in an area of Straight-Shippa extremely gravelly loams, 35 to 60 percent south slopes, about 9 miles north of Trail; about 1,550 feet west and 1,050 feet south of the northeast corner of sec. 23, T. 32 S., R. 1 W.

A—0 to 4 inches; dark brown (7.5YR 3/2) extremely gravelly loam, pinkish gray (7.5YR 6/2) dry; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine irregular pores; 50 percent gravel and 15 percent cobbles; slightly acid (pH 6.4); clear smooth boundary.

Bw—4 to 16 inches; brown (7.5YR 4/4) extremely cobbly loam, light brown (7.5YR 6/4) dry; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine tubular pores; 20 percent gravel and 50 percent cobbles; moderately acid (pH 6.0); abrupt wavy boundary.

R—16 inches; fractured andesite; roots and soil material in some cracks in the upper few inches.

The depth to bedrock is 12 to 20 inches. The particle-size control section contains 40 to 75 percent rock fragments and 18 to 27 percent clay.

The A horizon has value of 3 or 4 moist, 6 or 7 dry, and chroma of 2 or 3 moist and dry. The Bw horizon has value of 6 or 7 dry and chroma of 3 or 4 moist and dry. It is very cobbly or extremely cobbly loam.

Shoat Series

The Shoat series consists of moderately deep, well drained soils on plateaus. These soils are on mounds in areas of patterned ground. They formed in loess over igneous rock. Slopes are 0 to 5 percent. The mean annual precipitation is about 22 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Shoat loam, in an area of Randcore-Shoat complex, 0 to 5 percent slopes; about 750 feet north and 200 feet east of the southwest corner of sec. 11, T. 41 S., R. 4 E.

A—0 to 4 inches; dark brown (7.5YR 3/2) loam, brown (7.5YR 4/4) dry; weak fine subangular blocky structure parting to weak very fine granular; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; 10 percent gravel; neutral (pH 6.7); clear smooth boundary.

Bw1—4 to 15 inches; dark brown (7.5YR 3/4) loam, brown (7.5YR 5/4) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; 10 percent gravel; neutral (pH 6.6); gradual smooth boundary.

Bw2—15 to 24 inches; dark brown (7.5YR 3/4) loam, brown (7.5YR 5/4) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many fine and medium tubular pores; 10 percent gravel; slightly acid (pH 6.5); abrupt wavy boundary.

2R—24 inches; andesite.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 18 to 30 percent clay.

The A horizon has hue of 10YR or 7.5YR; value of 3 moist, 4 or 5 dry; and chroma of 3 moist, 3 or 4 dry. The Bw horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 5 or 6 dry; and chroma of 4 moist, 3 or 4 dry. It is clay loam, loam, or silt loam.

Sibannac Series

The Sibannac series consists of very deep, poorly drained soils in basins. These soils formed in mixed alluvium derived from igneous rock. Slopes are 0 to 7 percent. The mean annual precipitation is about 35 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Sibannac silt loam, 0 to 7 percent slopes; about 910 feet east and 2,525 feet north of the southwest corner of sec. 10, T. 38 S., R. 3 E.

A1—0 to 6 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak very fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; moderately acid (pH 5.8); abrupt smooth boundary.

A2—6 to 11 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky and granular structure; hard, friable, sticky and plastic; few fine and many very fine roots; many very fine irregular pores; moderately acid (pH 6.0); clear smooth boundary.

Bw1—11 to 27 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; many very fine irregular pores; slightly acid (pH 6.2); gradual smooth boundary.

2Bw2—27 to 32 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; few faint dark brown (7.5YR 4/4) mottles; moderate

medium subangular blocky structure; hard, firm, very sticky and very plastic; common very fine roots; few fine tubular and many very fine irregular pores; slightly acid (pH 6.3); gradual smooth boundary.

2C1—32 to 42 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; common fine distinct dark brown (7.5YR 4/4) and strong brown (7.5YR 4/6) mottles; massive; slightly hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; slightly acid (pH 6.4); clear smooth boundary.

3C2—42 to 60 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; massive; slightly hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; slightly acid (pH 6.4).

The depth to bedrock is 60 inches or more. The soils are saturated to the surface for at least 1 month in most years. The particle-size control section contains 27 to 35 percent clay. The mollic epipedon is 24 to 40 inches thick. The soils are characterized by an irregular decrease in content of organic matter to a depth of 50 inches.

The A horizon has value of 2 or 3 moist, 3 or 4 dry, and chroma of 1 or 2 moist and dry. The 2Bw horizon has chroma of 1 or 2 moist and dry. It is clay loam or silty clay loam. The 2C and 3C horizons have value of 2 or 3 moist and chroma of 1 or 2 moist and dry. They are clay loam or silty clay loam.

Siskiyou Series

The Siskiyou series consists of moderately deep, somewhat excessively drained soils on hillslopes. These soils formed in colluvium derived from granitic rock. Slopes are 35 to 60 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Siskiyou gravelly sandy loam, 35 to 60 percent north slopes; about 100 feet east and 550 feet south of the northwest corner of sec. 24, T. 34 S., R. 4 W.

Oi—1 inch to 0: needles and twigs.

A—0 to 9 inches; dark brown (10YR 3/3) gravelly sandy loam, pale brown (10YR 6/3) dry; strong fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and common medium roots; many irregular pores; 15 percent gravel; moderately acid (pH 5.6); abrupt smooth boundary.

Bw—9 to 17 inches; olive brown (2.5Y 4/4) sandy loam, light gray (2.5Y 7/3) dry; moderate very fine and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; common irregular pores; 10 percent gravel; moderately acid (pH 5.6); gradual wavy boundary.

C—17 to 35 inches; grayish brown (2.5Y 5/3) sandy loam, light gray (2.5Y 7/3) dry; massive; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; common irregular pores; 10 percent gravel; strongly acid (pH 5.4); gradual irregular boundary.

Cr—35 inches; decomposed granodiorite.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 8 to 12 percent clay, 10 to 35 percent rock fragments, and 15 to 50 percent coarse sand and very coarse sand.

The A horizon has value of 3 or 4 moist, 4 to 6 dry, and chroma of 2 or 3 moist and dry. The Bw horizon has hue of 10YR, 7.5YR, or 2.5Y; value of 4 or 5 moist, 5 to 7 dry; and chroma of 2 to 4 moist and dry. It is gravelly coarse sandy loam, sandy loam, or gravelly sandy loam. The C horizon has hue of 10YR or 2.5Y; value of 5 or 6 moist, 7 or 8 dry; and chroma of 2 to 4 moist and dry. It is sandy loam or coarse sandy loam. Some pedons have loamy coarse sand in the lower part.

Skookum Series

The Skookum series consists of moderately deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium and residuum derived from igneous rock. Slopes are 1 to 70 percent. The mean annual precipitation is about 25 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Skookum very cobbly loam, in an area of Skookum-Rock outcrop-Rubble land complex, 35 to 70 percent slopes, about 6 miles south of Pinehurst; about 1,650 feet west and 40 feet north of the southeast corner of sec. 4, T. 41 S., R. 4 E.

A—0 to 3 inches; very dark brown (10YR 2/2) very cobbly loam, dark grayish brown (10YR 4/2) dry; weak very fine and fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 15 percent gravel, 30 percent cobbles, and 5 percent stones; neutral (pH 7.2); abrupt wavy boundary.

BAt—3 to 8 inches; very dark grayish brown (10YR 3/2) very cobbly loam, dark grayish brown (10YR 4/3) dry; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; few faint clay films on faces of peds and in

pores; 10 percent gravel and 25 percent cobbles; neutral (pH 7.0); clear wavy boundary.

Bt1—8 to 16 inches; very dark grayish brown (10YR 3/2) very cobbly clay loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; few faint clay films on faces of peds and in pores; 10 percent gravel and 45 percent cobbles; neutral (pH 6.7); gradual wavy boundary.

Bt2—16 to 22 inches; dark brown (7.5YR 3/3) very cobbly clay, brown (7.5YR 4/2) dry; moderate fine and medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few medium roots; few very fine tubular pores; few faint clay films on faces of peds and in pores; 10 percent gravel and 45 percent cobbles; neutral (pH 6.7); gradual wavy boundary.

Bt3—22 to 28 inches; dark brown (7.5YR 3/4) extremely cobbly clay, brown (7.5YR 4/2) dry; moderate fine angular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; few very fine tubular pores; few faint clay films on faces of peds and in pores; 40 percent cobbles and 30 percent stones; neutral (pH 6.7); abrupt irregular boundary.

R—28 inches; fractured andesite.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 50 percent clay and 40 to 80 percent rock fragments. The mollic epipedon is 20 to 30 inches thick.

The A horizon has value of 2 or 3 moist, 3 or 4 dry, and chroma of 2 or 3 moist and dry. The Bt horizon has hue of 10YR or 7.5YR, value of 3 or 4 dry, and chroma of 2 to 4 moist, 2 to 3 dry. It is very cobbly clay loam, very cobbly clay, or extremely cobbly clay.

Snowbrier Series

The Snowbrier series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from altered volcanic rock. Slopes are 25 to 50 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Snowbrier gravelly loam, 25 to 50 percent south slopes; about 700 feet north and 1,250 feet east of the southwest corner of sec. 6, T. 33 S., R. 2 W.

Oi—1 inch to 0; needles, leaves, and twigs.

A1—0 to 5 inches; very dark brown, (10YR 2/2) gravelly loam, brown (10YR 4/3) dry; moderate fine granular structure; soft, friable, nonsticky and nonplastic; many very fine and common fine, medium, and coarse roots; many very fine irregular pores; 15 percent gravel; strongly acid (pH 5.4); clear smooth boundary.

A2—5 to 12 inches; very dark grayish brown (10YR 3/2) gravelly loam, brown (10YR 4/3) dry; moderate very fine and fine subangular blocky structure; soft, friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; many very fine tubular pores; 20 percent gravel and 5 percent cobbles; moderately acid (pH 5.6); clear wavy boundary.

Bw1—12 to 22 inches; dark grayish brown (2.5Y 4/2) very gravelly loam, light olive brown (2.5Y 5/4) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine, fine, and medium roots; common very fine tubular pores; 30 percent gravel and 10 percent cobbles; moderately acid (pH 5.6); clear wavy boundary.

Bw2—22 to 39 inches; olive (5Y 4/3) very cobbly loam, olive (5Y 5/3) dry; weak very fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine, fine, and medium roots; common very fine tubular pores; 35 percent gravel and 20 percent cobbles; moderately acid (pH 5.6); clear wavy boundary.

R—39 inches; fractured schist.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 75 percent rock fragments and 15 to 25 percent clay. The umbric epipedon is 10 to 20 inches thick.

The A horizon has hue of 10YR, 2.5Y, or 5Y; value of 2 or 3 moist, 3 to 5 dry; and chroma of 1 or 2 moist, 2 or 3 dry. The Bw horizon has hue of 10YR, 2.5Y, or 5Y; value of 3 or 4 moist, 5 or 6 dry; and chroma of 2 or 3 moist, 2 to 4 dry. It is very gravelly, very cobbly, or extremely cobbly loam.

Snowlin Series

The Snowlin series consists of very deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium derived from igneous rock and containing volcanic ash. Slopes are 3 to 35 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Snowlin gravelly loam, 3 to 12 percent slopes, on Bald Mountain; about 1,650 feet west and 1,600 feet north of the southeast corner of sec. 14, T. 32 S., R. 2 E.

Oi—2 inches to 0; needles and twigs.

A—0 to 6 inches; dark reddish brown (5YR 2.5/2)

gravelly loam, dark brown (7.5YR 3/2) dry; moderate fine granular structure; soft, friable, nonsticky and nonplastic; many very fine and fine and common medium and coarse roots; many fine irregular pores; 15 percent gravel; moderately acid (pH 5.6); abrupt smooth boundary.

AB—6 to 20 inches; dark reddish brown (5YR 3/2) gravelly loam, brown (7.5YR 5/2) dry; moderate very fine and fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine irregular pores; 15 percent gravel; moderately acid (pH 5.6); clear smooth boundary.

Bw1—20 to 34 inches; dark reddish brown (5YR 3/3) gravelly clay loam, brown (7.5YR 5/3) dry; moderate very fine and fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; common very fine and fine pores; 20 percent gravel and 5 percent cobbles; strongly acid (pH 5.4); abrupt wavy boundary.

Bw2—34 to 60 inches; dark reddish brown (5YR 3/3) very gravelly clay loam, brown (7.5YR 5/3) dry; moderate fine and medium subangular blocky structure; soft, friable, slightly sticky and plastic; few very fine, fine, and medium roots; common very fine pores; 35 percent gravel and 10 percent cobbles; strongly acid (pH 5.4).

The depth to bedrock is 60 inches or more. The particle-size control section contains 27 to 35 percent clay and 5 to 35 percent rock fragments. The umbric epipedon is 10 to 20 inches thick.

The A and AB horizons have hue of 10YR, 7.5YR, or 5YR; value of 2 or 3 moist, 3 to 5 dry; and chroma of 1 or 2 moist, 2 to 4 dry. They have a bulk density of 0.85 to 0.95 gram per cubic centimeter. The Bw horizon has hue of 10YR, 7.5YR, or 5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist and dry. It is dominantly gravelly clay loam, cobbly clay loam, or clay loam. In some pedons, however, it is very gravelly in the lower part.

Speaker Series

The Speaker series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from altered sedimentary and volcanic rock. Slopes are 12 to 55 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Speaker loam, in an area of Josephine-Speaker complex, 12 to 35 percent south slopes, near East Evans Creek; about 2,280 feet west and 1,850 feet north of the southeast corner of sec. 27, T. 34 S., R. 3 W.

Oi—1 inch to 0; leaves, needles, twigs, and grasses.

A1—0 to 2 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; strong very fine and fine granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many fine and medium irregular pores; 10 percent gravel; slightly acid (pH 6.5); abrupt smooth boundary.

A2—2 to 6 inches; dark brown (10YR 3/3) loam, brown (7.5YR 5/3) dry; moderate medium and coarse granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine and few coarse and medium roots; many very fine and fine irregular pores; 10 percent gravel; slightly acid (pH 6.3); abrupt smooth boundary.

AB—6 to 13 inches; dark brown (7.5YR 3/4) loam, brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; common fine irregular and very fine tubular pores; 10 percent gravel; moderately acid (pH 5.9); clear smooth boundary.

Bt1—13 to 23 inches; dark brown (7.5YR 3/4) loam, brown (7.5YR 5/4) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common very fine, fine, medium, and coarse roots; few fine irregular and common very fine and fine tubular pores; few faint and distinct clay films in pores; 10 percent gravel; moderately acid (pH 5.6); clear wavy boundary.

Bt2—23 to 35 inches; brown (7.5YR 4/4) gravelly clay loam, strong brown (7.5YR 4/6) dry; strong medium subangular blocky structure; hard, firm, sticky and plastic; few very fine, fine, medium, and coarse roots; few fine and common medium tubular pores; common faint and distinct clay films in pores; 15 percent gravel and 5 percent cobbles; moderately acid (pH 5.6); abrupt irregular boundary.

Cr—35 inches; decomposed schist.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 25 to 35 percent clay and 0 to 30 percent rock fragments.

The A horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 to 6 moist and dry. The Bt horizon has hue of 7.5YR or 5YR; value of 4 or 5 moist, 4 to 7 dry; and chroma of 4 to 6 moist and dry. It is gravelly clay loam, clay loam, gravelly loam, or loam.

Steinmetz Series

The Steinmetz series consists of very deep, somewhat excessively drained soils on hillslopes. These soils formed in colluvium derived from granitic rock. Slopes are 35 to 75 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Steinmetz sandy loam, 35 to 75 percent north slopes; about 2,300 feet east and 2,150 feet south of the northwest corner of sec. 5, T. 33 S., R. 3 W.

Oi—1 inch to 0; needles and twigs.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) sandy loam, pale brown (10YR 6/3) dry; strong fine granular structure; hard, very friable, nonsticky and slightly plastic; many very fine, fine, and medium roots; many very fine irregular pores; 10 percent gravel and 3 percent cobbles; slightly acid (pH 6.4); clear smooth boundary.

AB—4 to 13 inches; brown (10YR 4/3) sandy loam, light yellowish brown (10YR 6/4) dry; moderate very fine and fine subangular blocky structure; hard, very friable, nonsticky and slightly plastic; common very fine, fine, and medium and few coarse roots; many very fine tubular pores; 10 percent gravel and 3 percent cobbles; moderately acid (pH 5.8); gradual wavy boundary.

Bw1—13 to 33 inches; dark yellowish brown (10YR 4/4) sandy loam, light yellowish brown (10YR 6/4) dry; moderate very fine and fine subangular blocky structure; hard, very friable, nonsticky and slightly plastic; common very fine, fine, and medium and few coarse roots; many very fine tubular pores; 10 percent gravel and 3 percent cobbles; moderately acid (pH 6.0); gradual wavy boundary.

Bw2—33 to 60 inches; brown (7.5YR 4/4) sandy loam, very pale brown (10YR 7/4) dry; moderate very fine and fine subangular blocky structure; hard, very friable, nonsticky and slightly plastic; few very fine, fine, medium, and coarse roots; common very fine tubular pores; 10 percent gravel and 3 percent cobbles; moderately acid (6.0).

The depth to bedrock is 60 inches or more. The particle-size control section contains 10 to 18 percent clay and 0 to 35 percent rock fragments.

The A horizon has hue of 10YR or 7.5YR; value of 2 to 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist and dry. The Bw horizon has hue of 10YR or 7.5YR; value of 4 or 5 moist, 6 to 8 dry; and chroma of 4 to 6 moist and dry. It is sandy loam or gravelly sandy loam. Some pedons have a BC or C horizon, which is sandy loam to very gravelly sand and in most pedons is underlain by weathered granodiorite.

Straight Series

The Straight series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from igneous rock. Slopes are 12 to 70 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Straight extremely gravelly loam, in an area of Straight-Shippa extremely gravelly loams, 35 to 60 percent south slopes, about 3.5 miles northwest of Trail on the West Fork of Trail Creek; about 2,050 feet west and 1,575 feet north of the southeast corner of sec. 13, T. 33 S., R. 2 W.

Oi—1½ inches to 0; twigs, needles, and leaves.

A—0 to 9 inches; dark reddish brown (5YR 2.5/2) extremely gravelly loam, dark brown (7.5YR 3/2) dry; strong very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many fine irregular pores; 75 percent gravel; moderately acid (pH 6.0); abrupt smooth boundary.

BA—9 to 19 inches; dark brown (7.5YR 3/4) very gravelly loam, pinkish gray (7.5YR 6/2) dry; strong medium and fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many fine irregular pores; 40 percent gravel and 10 percent cobbles; moderately acid (pH 5.8); clear smooth boundary.

Bw1—19 to 30 inches; dark brown (7.5YR 4/4) very gravelly loam, light yellowish brown (10YR 6/4) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine irregular pores; 35 percent gravel and 10 percent cobbles; moderately acid (pH 5.8); clear wavy boundary.

Bw2—30 to 35 inches; dark brown (7.5YR 4/4) very cobbly clay loam, light yellowish brown (10YR 6/4) dry; moderate fine and very fine subangular blocky structure; hard, friable, slightly sticky and plastic; common fine roots; many very fine and fine irregular pores; 30 percent gravel and 20 percent cobbles; moderately acid (pH 5.6); clear wavy boundary.

Cr—35 inches; partially weathered, fractured andesite.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 35 to 60 percent rock fragments and 18 to 30 percent clay.

The A horizon has hue of 7.5YR or 5YR; value of 2 to 3 moist, 3 to 6 dry; and chroma of 2 or 3 moist and

dry. The Bw horizon has hue of 7.5YR or 5YR moist, 5YR, 7.5YR, or 10YR dry; value of 3 or 4 moist; and chroma of 2 to 4 moist and dry. It is very gravelly loam, very gravelly clay loam, or very cobbly clay loam.

Tablerock Series

The Tablerock series consists of very deep, moderately well drained soils on hillslopes and alluvial fans. These soils formed in colluvium derived from igneous and sedimentary rock. Slopes are 20 to 50 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Tablerock gravelly loam, in an area of Carney-Tablerock complex, 20 to 35 percent slopes; about 2,400 feet west and 200 feet north of the southeast corner of sec. 4, T. 36 S., R. 2 W.

Oi—1½ inches to 0; leaves, twigs, and moss.

A—0 to 3 inches; very dark brown (10YR 2/2) gravelly loam, brown (10YR 5/3) dry; strong very fine, fine, and medium granular and moderate very fine and fine subangular blocky structure; slightly hard, firm, sticky and plastic; many very fine roots; common fine and medium irregular pores; 15 percent gravel; slightly acid (pH 6.1); abrupt smooth boundary.

BAt—3 to 10 inches; very dark grayish brown (10YR 3/2) very cobbly clay loam, brown (10YR 5/3) dry; moderate very fine and fine subangular blocky structure; slightly hard, firm, sticky and plastic; common very fine and few fine roots; common very fine and fine tubular and few fine irregular pores; few faint clay films on faces of peds; 20 percent gravel and 15 percent cobbles; moderately acid (pH 6.0); abrupt smooth boundary.

Bt1—10 to 20 inches; dark brown (10YR 3/3) very cobbly clay loam, brown (10YR 4/3) dry; strong very fine and fine subangular blocky structure; hard, firm, sticky and very plastic; few very fine and fine roots; common very fine and fine tubular and common fine irregular pores; many distinct clay films on faces of peds and in pores; 25 percent gravel and 20 percent cobbles; moderately acid (pH 5.8); clear smooth boundary.

Bt2—20 to 29 inches; brown (10YR 4/3) very cobbly clay, brown (10YR 4/3) dry; common fine distinct gray (10YR 5/1) mottles; moderate medium and coarse angular blocky structure; very hard, firm, very sticky and very plastic; few very fine, fine, and medium roots; few very fine tubular pores; many distinct and prominent clay films on faces of peds and in pores; common slickensides; 20 percent gravel and 15 percent cobbles; moderately acid (pH 5.6); clear wavy boundary.

Bt3—29 to 38 inches; brown (10YR 4/3) very cobbly clay, dark yellowish brown (10YR 4/4) dry; weak medium and coarse angular blocky structure; very hard, firm, very sticky and very plastic; few very fine, fine, and medium roots; few very fine tubular pores; many prominent clay films on faces of peds and in pores; few slickensides; 10 percent gravel and 40 percent cobbles and stones; moderately acid (pH 5.6); clear wavy boundary.

Bt4—38 to 49 inches; dark yellowish brown (10YR 4/4) gravelly clay loam, pale brown (10YR 6/3) dry; weak fine and medium subangular blocky structure; slightly hard, very firm, sticky and very plastic; few fine and medium roots; few very fine tubular pores; many faint clay films on faces of peds and common distinct clay films on faces of peds and in pores; common small black stains; 20 percent gravel and 10 percent cobbles; strongly acid (pH 5.5); gradual wavy boundary.

BCt—49 to 65 inches; dark yellowish brown (10YR 4/4) gravelly loam, very pale brown (10YR 7/3) dry; massive; slightly hard, very firm, slightly sticky and plastic; few fine and medium roots; many distinct and faint clay films on faces of peds; common small black stains; 20 percent gravel and 10 percent cobbles; moderately acid (pH 5.7); gradual wavy boundary.

2Cr—65 inches; weathered sandstone.

The depth to bedrock is 60 inches or more. The particle-size control section contains 35 to 60 percent clay and 35 to 60 percent rock fragments. The mollic epipedon is 20 to 30 inches thick.

The A horizon has hue of 10YR, 7.5YR, or 2.5Y; value of 2 or 3 moist, 3 to 5 dry; and chroma of 2 or 3 moist and dry. The upper part of the Bt horizon has hue of 10YR, 7.5YR, or 2.5Y; value of 3 or 4 moist, 3 to 6 dry; and chroma of 2 to 6 moist and dry. It is very cobbly clay loam or very cobbly clay. The lower part of the Bt horizon and the BCt horizon have hue of 10YR or 2.5Y; value of 4 or 5 moist, 6 to 8 dry; and chroma of 3 or 4 moist and dry. They are gravelly clay loam, gravelly loam, or very cobbly clay loam and contain 20 to 35 percent clay.

Takilma Series

The Takilma series consists of very deep, well drained soils on stream terraces. These soils formed in alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 52 degrees F.

Typical pedon of Takilma cobbly loam, 0 to 3 percent

slopes, about 3 miles south of Ruch; about 1,380 feet east and 625 feet south of the northwest corner of sec. 10, T. 39 S., R. 3 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) cobbly loam, brown (10YR 5/3) dry; moderate fine and medium granular and moderate medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; many roots; many irregular pores; 15 percent gravel and 10 percent cobbles; slightly acid (pH 6.2); abrupt smooth boundary.

Bw—6 to 15 inches; very dark grayish brown (10YR 3/2) very cobbly loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; common fine and medium irregular pores; 30 percent gravel and 20 percent cobbles; slightly acid (pH 6.4); clear smooth boundary.

BC—15 to 24 inches; brown (10YR 4/3) extremely cobbly sandy loam, yellowish brown (10YR 5/4) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many irregular pores; 35 percent gravel and 30 percent cobbles; neutral (pH 6.6); clear wavy boundary.

C1—24 to 34 inches; brown (10YR 4/3) very gravelly sandy loam, yellowish brown (10YR 5/4) dry; single grain; loose, very friable, nonsticky and nonplastic; few very fine roots; common irregular pores; 40 percent gravel and 15 percent cobbles; neutral (pH 6.6); gradual wavy boundary.

C2—34 to 60 inches; dark yellowish brown (10YR 4/4) extremely gravelly sandy loam, yellowish brown (10YR 5/4) dry; single grain; loose, nonsticky and nonplastic; few roots; many fine irregular pores; 60 percent gravel and 20 percent cobbles; neutral (pH 6.6).

The depth to bedrock is 60 inches or more. The particle-size control section contains 50 to 80 percent rock fragments and 12 to 18 percent clay. The mollic epipedon is 12 to 20 inches thick.

The A horizon has hue of 7.5YR or 10YR; value of 2 or 3 moist, 4 or 5 dry; and chroma of 2 or 3 moist, 2 to 4 dry. The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5 dry, and chroma of 2 or 3 moist, 3 or 4 dry. It is very cobbly loam or very cobbly clay loam. The BC and C horizons have hue of 7.5YR or 10YR; value of 3 or 4 moist, 5 or 6 dry; and chroma of 3 or 4 moist and dry. They are very gravelly sandy loam, extremely gravelly sandy loam, or extremely cobbly sandy loam.

Tallowbox Series

The Tallowbox series consists of moderately deep, somewhat excessively drained soils on hillslopes and ridges. These soils formed in colluvium derived from granitic rock. Slopes are 20 to 70 percent. The mean annual precipitation is about 32 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Tallowbox gravelly sandy loam, 35 to 70 percent north slopes, about 8 miles southeast of Ruch; about 490 feet north and 1,190 feet east of the southwest corner of sec. 30, T. 39 S., R. 2 W.

Oi—1 inch to 0; leaves, needles, and twigs.

A—0 to 6 inches; dark brown (7.5YR 3/2) gravelly sandy loam, pale brown (10YR 6/3) dry; strong fine granular structure; soft, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine irregular pores; 15 percent gravel; slightly acid (pH 6.5); abrupt smooth boundary.

BA—6 to 12 inches; dark brown (7.5YR 3/4) sandy loam, light yellowish brown (10YR 6/4) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common very fine and fine irregular pores; 10 percent gravel; slightly acid (pH 6.4); clear wavy boundary.

Bw1—12 to 17 inches; brown (7.5YR 4/4) gravelly sandy loam, light brown (7.5YR 6/4) dry; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; 20 percent gravel; moderately acid (pH 5.7); clear wavy boundary.

Bw2—17 to 23 inches; brown (7.5YR 4/4) gravelly sandy loam, light brown (7.5YR 6/4) dry; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few roots; common very fine and fine tubular pores; 25 percent gravel; moderately acid (pH 5.6); clear wavy boundary.

Cr—23 inches; decomposed granitic rock.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 8 to 12 percent clay and 0 to 35 percent rock fragments.

The A horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 or 3 moist and dry. The Bw horizon has hue of 10YR, 7.5YR, or 2.5Y; value of 4 or 5 moist, 5 or 6 dry; and chroma of 3 to 6 moist and dry. It is gravelly sandy loam, gravelly coarse sandy loam, or sandy loam.

Tatouche Series

The Tatouche series consists of very deep, well drained soils on hillslopes. These soils formed in colluvium derived from igneous rock. Slopes are 12 to 65 percent. The mean annual precipitation is about 40 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Tatouche gravelly loam, in an area of Bybee-Tatouche complex, 12 to 35 percent north slopes, about 10 miles southeast of Ashland along an access road to the north end of a railroad tunnel at Siskiyou Summit; about 990 feet north and 1,590 feet west of the southeast corner of sec. 20, T. 40 S., R. 2 E.

Oi—2 inches to 0; twigs and needles.

A1—0 to 5 inches; very dark brown (10YR 2/2) gravelly loam, dark grayish brown (10YR 4/2) dry; strong fine and very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many very fine pores; 20 percent gravel and 5 percent cobbles; neutral (pH 6.6); abrupt smooth boundary.

A2—5 to 11 inches; very dark brown (10YR 2/2) gravelly loam, dark grayish brown (10YR 4/2) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and medium roots; many very fine tubular pores; 10 percent gravel and 5 percent cobbles; slightly acid (pH 6.5); clear smooth boundary.

Bt1—11 to 19 inches; dark brown (7.5YR 3/4) gravelly clay loam, dark brown (10YR 4/3) dry; moderate medium and fine subangular blocky structure; hard, firm, sticky and plastic; common medium and few fine and coarse roots; few very fine tubular pores; 10 percent gravel and 5 percent cobbles; few distinct and faint clay films on faces of peds and in pores; slightly acid (pH 6.4); clear smooth boundary.

Bt2—19 to 34 inches; dark brown (7.5YR 4/4) clay, dark brown (10YR 4/4) dry; moderate medium and fine subangular blocky structure; very hard, firm, very sticky and very plastic; common medium and few fine and coarse roots; many very fine tubular pores; 10 percent soft gravel; common distinct clay films on faces of peds and in pores; slightly acid (pH 6.2); gradual wavy boundary.

Bt3—34 to 60 inches; dark brown (7.5YR 4/4) clay, brown (7.5YR 5/4) dry; weak medium and coarse subangular blocky structure; very hard, firm, very sticky and very plastic; few roots; many very fine tubular pores; 10 percent soft gravel; common distinct clay films on faces of peds and in pores; moderately acid (pH 5.8); gradual wavy boundary.

2C—60 to 73 inches; strong brown (7.5YR 4/6) clay loam, yellowish brown (10YR 5/5) dry; massive; hard, firm, sticky and plastic; 5 percent soft gravel; common black stains; moderately acid (pH 5.6).

The depth to bedrock is 60 inches or more. The particle-size control section contains 35 to 50 percent clay and 10 to 30 percent rock fragments.

The A horizon has hue of 10YR or 7.5YR; value of 2 or 3 moist, 3 or 4 dry; and chroma of 2 or 3 moist and dry. Some pedons have a 2Bt horizon. The Bt and 2Bt horizons have hue of 10YR, 7.5YR, or 5YR; value of 3 or 4 moist, 4 or 5 dry; and chroma of 3 or 4 moist and dry. They are clay, clay loam, or gravelly clay loam. The 2C horizon is clay loam or gravelly clay loam.

Terrabella Series

The Terrabella series consists of very deep, poorly drained soils in basins. These soils formed in alluvium derived from igneous rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 35 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Terrabella clay loam, 0 to 3 percent slopes, about 5.5 miles northeast of Butte Falls, along Butte Falls-Prospect Highway; about 2,270 feet south and 1,625 feet west of the northeast corner of sec. 21, T. 34 S., R. 3 E.

Oi—1 inch to 0; grass root mat.

A—0 to 5 inches; very dark brown (10YR 2/2) clay loam, very dark grayish brown (10YR 3/2) dry; few fine prominent reddish yellow (5YR 6/8) and few fine distinct red (2.5YR 4/8) mottles; strong fine granular structure; hard, very friable, sticky and plastic; many very fine and few fine roots; many very fine and common fine irregular pores; 5 percent gravel; moderately acid (pH 5.6); clear smooth boundary.

BA—5 to 10 inches; very dark brown (7.5YR 2/2) clay loam, dark brown (7.5YR 3/2) dry; few fine distinct red (2.5YR 4/8) mottles; moderate very fine and fine subangular blocky structure; very hard, firm, sticky and very plastic; common very fine and few fine, medium, and coarse roots; few very fine irregular pores; few stress surfaces; 5 percent gravel; moderately acid (pH 5.6); clear smooth boundary.

Bt1—10 to 16 inches; dark reddish brown (5YR 3/3) clay, dark reddish gray (5YR 4/2) dry; few fine distinct yellowish red (5YR 5/8) and red (2.5YR 4/8) mottles; strong medium subangular blocky structure; very hard, firm, very sticky and very plastic; few very fine, fine, medium, and coarse roots; few very

fine tubular pores; many faint clay films in pores; 5 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

Bt2—16 to 28 inches; dark reddish gray (5YR 4/2) clay, reddish gray (5YR 5/2) dry; few fine distinct yellowish red (5YR 5/8), very dark gray (5YR 3/1), and red (2.5YR 4/8) mottles; strong medium and coarse prismatic structure; extremely hard, extremely firm, very sticky and very plastic; few medium and coarse roots; few very fine tubular pores; continuous prominent clay films in pores; 5 percent gravel; slightly acid (pH 6.3); gradual smooth boundary.

Bt3—28 to 50 inches; dark brown (7.5YR 3/4) clay, brown (7.5YR 5/4) dry; common fine distinct yellowish red (5YR 5/6) and few fine distinct yellowish red (5YR 5/8) mottles; weak coarse angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few medium roots; few very fine tubular pores; continuous prominent clay films on faces of peds and in pores; 5 percent gravel; slightly acid (pH 6.3); diffuse smooth boundary.

C—50 to 60 inches; dark yellowish brown (10YR 4/4) gravelly clay loam, light yellowish brown (10YR 6/4) dry; many medium distinct yellowish red (5YR 5/6) mottles; massive; very hard, firm, sticky and plastic; 15 percent gravel; slightly acid (pH 6.4).

The depth to bedrock is 60 inches or more. The soils are saturated to the surface for at least 1 month in most years. The particle-size control section contains 40 to 55 percent clay. In most years the soils have cracks that are open to the surface or to the base of a plow layer. These cracks are at least 1 centimeter wide at a depth of 20 inches. The soils do not have intersecting slickensides.

The A horizon has hue of 10YR or 7.5YR; value of 2 or 3 moist, 3 or 4 dry; and chroma of 2 or 3 moist and dry. The Bt horizon has hue of 7.5YR or 5YR; value of 3 or 4 moist, 4 or 5 dry; and chroma of 2 to 4 moist and dry. The C horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 or 5 moist, 6 or 7 dry; and chroma of 3 or 4 moist and dry. It is clay loam, clay, or gravelly clay loam and contains 0 to 20 percent gravel.

Tethrick Series

The Tethrick series consists of very deep, well drained soils on hillslopes. These soils formed in colluvium derived from granitic rock. Slopes are 35 to 75 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Tethrick sandy loam, 35 to 75 percent north slopes, about 17 miles north of Gold Hill; about 2,300 feet east and 1,200 feet north of the southwest corner of sec. 19, T. 33 S., R. 3 W.

Oi—1 inch to 0; needles, leaves, and twigs.

A1—0 to 2 inches; dark grayish brown (10YR 4/2) sandy loam, grayish brown (10YR 5/2) dry; strong fine and medium granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; many very fine and fine irregular pores; moderately acid (pH 5.8); abrupt smooth boundary.

A2—2 to 10 inches; brown (10YR 4/3) sandy loam, very pale brown (10YR 7/3) dry; moderate very fine and fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; many very fine and fine irregular pores; moderately acid (pH 5.6); abrupt smooth boundary.

Bw1—10 to 21 inches; yellowish brown (10YR 5/4) sandy loam, very pale brown (10YR 7/4) dry; moderate very fine and fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; common very fine and fine irregular pores; moderately acid (pH 5.6); clear smooth boundary.

Bw2—21 to 31 inches; light yellowish brown (10YR 6/4) sandy loam, very pale brown (10YR 8/4) dry; weak very fine and fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; common very fine and fine irregular pores; strongly acid (pH 5.2); clear smooth boundary.

Bw3—31 to 49 inches; very pale brown (10YR 7/3) sandy loam, very pale brown (10YR 8/3) dry; weak very fine and fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; common very fine and fine irregular pores; strongly acid (pH 5.1); clear smooth boundary.

C—49 to 60 inches; very pale brown (10YR 7/3) sandy loam, very pale brown (10YR 8/3) dry; massive; hard, very friable, nonsticky and nonplastic; few very fine and fine irregular pores; strongly acid (pH 5.1).

The depth to bedrock is 60 inches or more. The particle-size control section contains 5 to 18 percent clay, 5 to 20 percent rock fragments, and 15 to 50 percent coarse sand and very coarse sand.

The A horizon has hue of 10YR or 2.5Y; value of 3 to 6 moist, 5 to 7 dry; and chroma of 2 or 3 moist and dry. The Bw and C horizons have hue of 10YR, 2.5Y, or 5Y; value of 4 to 7 moist, 5 to 8 dry; and chroma of 2 to 6

moist and dry. They are coarse sandy loam or sandy loam.

Vannoy Series

The Vannoy series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from altered sedimentary and volcanic rock. Slopes are 12 to 55 percent. The mean annual precipitation is about 32 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Vannoy silt loam, 12 to 35 percent north slopes, about 1 mile southwest of Jacksonville and 1,580 feet east of State Highway 238; about 2,340 feet east and 3,100 feet south of the northwest corner of sec. 31, T. 37 S., R. 2 W.

Oi—¾ inch to 0; needles, leaves, and twigs.

A1—0 to 2 inches; dark brown (7.5YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; slightly hard, friable, sticky and slightly plastic; many very fine and fine roots; many very fine irregular pores; 5 percent gravel; slightly acid (pH 6.5); abrupt wavy boundary.

A2—2 to 4 inches; dark brown (7.5YR 4/4) silt loam, pale brown (10YR 6/3) dry; weak medium and moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine irregular and common very fine tubular pores; 5 percent gravel; slightly acid (pH 6.3); clear smooth boundary.

BA—4 to 11 inches; reddish brown (5YR 4/4) silt loam, light brown (7.5YR 6/4) dry; weak medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; many fine and very fine tubular pores; 5 percent gravel; strongly acid (pH 5.4); clear smooth boundary.

2Bt1—11 to 19 inches; yellowish red (5YR 4/6) clay loam, yellowish red (5YR 5/6) dry; moderate fine subangular blocky structure; very hard, friable, sticky and plastic; common fine and medium roots; many very fine tubular pores; common distinct clay films on faces of peds; 5 percent soft gravel; moderately acid (pH 5.6); clear smooth boundary.

2Bt2—19 to 26 inches; yellowish red (5YR 4/6) clay loam, yellowish red (5YR 5/6) dry; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; common fine and medium roots; many very fine tubular pores; common distinct clay films on faces of peds; 12 percent soft gravel; moderately acid (pH 6.0); clear smooth boundary.

2Bt3—26 to 35 inches; yellowish red (5YR 4/6) clay loam, yellowish red (5YR 5/6) dry; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; many very fine tubular pores; common distinct red (2.5YR 4/6) clay films on faces of peds and on soft rock fragments; 30 percent soft rock fragments; moderately acid (pH 6.0); gradual wavy boundary.

2BCt—35 to 38 inches; yellowish red (5YR 4/6) clay loam, yellowish red (5YR 4/6) dry; massive; very hard, firm, sticky and plastic; few fine roots; many very fine and fine tubular pores; common distinct red (2.5YR 4/6) clay films on soft rock fragments; 75 percent soft rock fragments; many black stains on pebbles; moderately acid (pH 5.9); gradual wavy boundary.

2Crt—38 inches; weathered, highly fractured, metamorphosed rock; many prominent dark red (2.5YR 3/6) clay films and many black stains in fracture planes.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 27 to 35 percent clay and 5 to 35 percent rock fragments.

The A horizon has hue of 7.5YR or 10YR; value of 3 or 4 moist, 5 to 7 dry; and chroma of 2 to 4 moist, 3 or 4 dry. The 2Bt horizon has hue of 7.5YR or 5YR; value of 4 or 5 moist, 5 or 6 dry; and chroma of 4 to 6 moist and dry.

Voorhies Series

The Voorhies series consists of moderately deep, well drained soils on hillslopes. These soils formed in colluvium derived from altered sedimentary and volcanic rock. Slopes are 35 to 55 percent. The mean annual precipitation is about 32 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Voorhies very gravelly loam, in an area of Vannoy-Voorhies complex, 35 to 55 percent south slopes, about 6 miles southwest of Medford, at the head of Griffin Creek; about 1,680 feet west and 790 feet south of the northeast corner of sec. 35, T. 38 S., R. 2 W.

Oi—1 inch to 0; needles and twigs.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) very gravelly loam, grayish brown (10YR 5/2) dry; weak fine and moderate very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine and few medium roots; many fine irregular pores; 55 percent gravel; neutral (pH 6.8); clear smooth boundary.

A2—3 to 8 inches; dark brown (10YR 3/3) very gravelly loam, brown (10YR 5/3) dry; weak fine granular and subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine and few medium roots; many fine irregular and very fine

tubular pores; 55 percent gravel; neutral (pH 6.8); clear smooth boundary.

BA—8 to 12 inches; brown (7.5YR 4/3) very gravelly clay loam, light brown (7.5YR 6/3) dry; moderate fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common fine and few medium roots; many very fine tubular pores; 40 percent gravel; thin bleached silt and sand grains on peds; slightly acid (pH 6.4); gradual wavy boundary.

Bt1—12 to 18 inches; brown (7.5YR 4/3) very gravelly clay loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine and few medium roots; common very fine and fine tubular pores; few faint clay films on faces of peds; 35 percent gravel and 10 percent cobbles; slightly acid (pH 6.4); clear smooth boundary.

Bt2—18 to 36 inches; brown (7.5YR 4/4) very cobbly clay loam, pink (7.5YR 7/3) dry; moderate medium subangular blocky structure; hard, firm, sticky and slightly plastic; few fine and medium roots; common very fine and fine tubular pores; common faint and few distinct clay films on faces of peds and in pores; 30 percent gravel and 25 percent cobbles; neutral (pH 6.6); gradual wavy boundary.

Cr—36 inches; partially consolidated, weathered metamorphic rock.

The depth to bedrock is 20 to 40 inches. The particle-size control section contains 25 to 35 percent clay and 35 to 60 percent rock fragments.

The A horizon has hue of 10YR or 7.5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist and dry. The Bt horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 or 5 moist, 5 to 7 dry; and chroma of 3 to 6 moist and dry. It is very gravelly clay loam, very cobbly clay loam, or very cobbly loam.

Whiteface Series

The Whiteface series consists of well drained soils on alluvial fans. These soils are shallow to a duripan. They formed in alluvium derived from igneous rock. Slopes are 1 to 12 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 42 degrees F.

Typical pedon of Whiteface cobbly loam, in an area of Aspenlake-Whiteface complex, 1 to 12 percent slopes, north of Aspen Lake; about 500 feet east and 1,550 feet south of the northwest corner of sec. 21, T. 37 S., R. 7 E.

A—0 to 8 inches; dark brown (7.5YR 3/2) cobbly loam, brown (10YR 4/3) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and few fine and medium roots; many very fine irregular pores; 10 percent gravel and 10 percent cobbles; moderately acid (pH 5.6); abrupt wavy boundary.

AB—8 to 12 inches; dark brown (7.5YR 3/3) gravelly loam, brown (10YR 5/3) dry; moderate very fine and fine angular blocky structure; hard, firm, sticky and plastic; common very fine and few fine and medium roots; many very fine irregular pores; 15 percent gravel; moderately acid (pH 5.8); abrupt wavy boundary.

2Bt—12 to 16 inches; dark brown (7.5YR 3/3) gravelly clay loam, brown (10YR 5/3) dry; moderate very fine and fine angular blocky structure; hard, firm, sticky and plastic; common very fine and few fine and medium roots; many very fine irregular pores; common faint clay films on faces of peds and in pores; 15 percent gravel; moderately acid (pH 5.8); abrupt wavy boundary.

2Bqm—16 to 23 inches; indurated, gravelly duripan.

Depth to the duripan is 10 to 20 inches. The depth to bedrock is 60 inches or more. The particle-size control section contains 25 to 35 percent clay and 15 to 35 percent rock fragments.

The A horizon has hue of 10YR or 7.5YR; value of 2 or 3 moist, 4 or 5 dry; and chroma of 2 or 3 moist and dry. The AB and 2Bt horizons have hue of 10YR or 7.5YR; value of 3 or 4 moist, 4 to 6 dry; and chroma of 2 or 3 moist and dry. They are gravelly loam or gravelly clay loam.

Winlo Series

The Winlo series consists of somewhat poorly drained soils on fan terraces. These soils are in between mounds in areas of patterned ground. They are shallow to a duripan. They formed in stratified alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Winlo very gravelly clay loam, in an area of Agate-Winlo complex, 0 to 5 percent slopes, about 500 feet west and 200 feet south of the intersection of Table Rock Road and Kirtland Road; about 1,150 feet east and 440 feet north of the southwest corner of sec. 13, T. 36 S., R. 2 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) very gravelly clay loam, grayish brown (10YR 5/2) dry; many fine distinct strong brown (7.5YR 5/6) mottles; strong fine and very fine granular structure; hard, firm, sticky and plastic; many fine and very

fine roots; 30 percent gravel and 10 percent cobbles; slightly acid (pH 6.2); clear smooth boundary.

Bw—4 to 9 inches; dark brown (7.5YR 3/2) very gravelly clay, brown (7.5YR 5/2) dry; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very hard, very firm, very sticky and very plastic; common fine and very fine roots; 40 percent gravel and 10 percent cobbles; slightly acid (pH 6.4); abrupt smooth boundary.

2Bqm—9 to 17 inches; yellowish red (5YR 4/6), indurated duripan, yellowish red (5YR 5/6) dry; massive; medium and fine nearly continuous silica laminae; common fine black stains; 40 percent gravel and 20 percent cobbles; clear smooth boundary.

2C1—17 to 42 inches; light olive brown (2.5Y 5/4) extremely gravelly coarse sandy loam, very pale brown (10YR 7/4) and yellow (10YR 7/6) dry; massive; slightly hard, very friable, nonsticky and nonplastic; discontinuous weakly cemented silica laminae; 55 percent gravel and 25 percent cobbles; neutral (pH 6.6); gradual smooth boundary.

2C2—42 to 60 inches; light olive brown (2.5Y 5/4) extremely gravelly coarse sandy loam, pale yellow (2.5Y 7/4) dry; massive; slightly hard, very friable, nonsticky and nonplastic; 55 percent gravel and 25 percent cobbles; neutral (pH 6.6).

Depth to the duripan is 7 to 15 inches. The depth to bedrock is 60 inches or more. The soils are saturated to the surface for at least 1 month in most years. The particle-size control section contains 35 to 60 percent rock fragments and 40 to 50 percent clay.

The A horizon has hue of 10YR or 7.5YR; value of 2 or 3 moist, 4 or 5 dry; and chroma of 1 or 2 moist and dry. The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5 dry, and chroma of 1 or 2 moist and dry. The duripan is indurated throughout or only in some part. It exhibits strong cementation. The 2C horizon has hue of 2.5Y, 10YR, 7.5YR, or 5YR; value of 4 to 6 moist, 6 or 7 dry; and chroma of 4 or 5 moist, 4 to 6 dry. It generally is coarse sandy loam or loamy sand in the fine-earth fraction and contains 50 to 60 percent gravel and 10 to 30 percent cobbles. In some pedons it has strata of loam or silt loam.

Wolfpeak Series

The Wolfpeak series consists of very deep, well drained soils on hillslopes and alluvial fans. These soils formed in alluvium, colluvium, and residuum derived from granitic rock. Slopes are 3 to 35 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Wolfpeak sandy loam, 12 to 35 percent south slopes; about 2,400 feet east and 500 feet south of the northwest corner of sec. 21, T. 33 S., R. 3 W.

Oi—½ inch to 0; needles, leaves, and twigs.

A—0 to 4 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; strong fine granular structure; slightly hard, friable, slightly sticky and nonplastic; many very fine and fine and common medium and coarse roots; many very fine irregular pores; 13 percent gravel; moderately acid (pH 5.6); clear smooth boundary.

BA—4 to 11 inches; brown (7.5YR 4/4) sandy loam, very pale brown (10YR 7/4) dry; strong fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many very fine and fine and common medium and coarse roots; many very fine irregular pores; 10 percent gravel; strongly acid (pH 5.4); clear wavy boundary.

Bt1—11 to 35 inches; yellowish brown (10YR 5/4) clay loam, very pale brown (10YR 7/4) dry; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine and few medium and coarse roots; common very fine tubular pores; many distinct clay films in pores and on faces of peds; 10 percent gravel and 3 percent cobbles; strongly acid (pH 5.4); gradual wavy boundary.

Bt2—35 to 60 inches; strong brown (7.5YR 5/6) clay loam, yellow (10YR 7/6) dry; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; common very fine tubular pores; many distinct clay films in pores and on faces of peds; 10 percent gravel and 3 percent cobbles; strongly acid (pH 5.4).

The depth to bedrock is 60 inches or more. The particle-size control section contains 25 to 35 percent clay and 5 to 25 percent rock fragments.

The A and BA horizons have hue of 10YR or 7.5YR; value of 3 to 5 moist, 4 to 7 dry; and chroma of 2 to 4 moist and dry. The Bt horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 to 6 moist, 5 to 7 dry; and chroma of 4 to 8 moist and dry. It is loam, clay loam, or gravelly clay loam.

Woodcock Series

The Woodcock series consists of very deep, well drained soils on plateaus and hillslopes. These soils formed in colluvium derived from igneous rock. Slopes are 1 to 55 percent. The mean annual precipitation is

about 30 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Woodcock stony loam, in an area of Pokegema-Woodcock complex, 1 to 12 percent slopes, about 3 miles northeast of Pinehurst; about 1,300 feet south and 1,800 feet west of the northeast corner of sec. 27, T. 39 S., R. 4 E.

Oi—1 inch to 0; needles and twigs.

A1—0 to 4 inches; dark reddish brown (5YR 3/2) stony loam, reddish brown (5YR 4/3) dry; moderate medium and fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine irregular pores; 5 percent gravel and 5 percent cobbles; stones covering 5 percent of the surface; neutral (pH 6.8); abrupt smooth boundary.

A2—4 to 16 inches; dark reddish brown (5YR 3/2) very gravelly loam, reddish brown (5YR 4/3) dry; weak fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; many fine roots; many fine irregular pores; 30 percent gravel and 5 percent cobbles; neutral (pH 7.0); clear smooth boundary.

2BA—16 to 20 inches; dark reddish brown (5YR 3/3) very gravelly clay loam, reddish brown (5YR 4/4) dry; moderate medium and fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common medium, fine, and very fine roots; common fine tubular pores; 50 percent gravel and 5 percent cobbles; slightly acid (pH 6.4); clear wavy boundary.

2Bt1—20 to 32 inches; dark reddish brown (5YR 3/4) very gravelly clay loam, reddish brown (5YR 4/4) dry; moderate medium and fine subangular blocky structure; hard, friable, sticky and plastic; common medium and few fine roots; common fine tubular pores; few faint clay films on faces of peds; 50 percent gravel and 5 percent cobbles; slightly acid (pH 6.2); clear smooth boundary.

2Bt2—32 to 39 inches; dark reddish brown (5YR 3/4) very gravelly clay loam, reddish brown (5YR 4/4) dry; moderate medium and fine subangular blocky structure; slightly hard, friable, sticky and plastic; common medium and few fine roots; common fine tubular pores; common faint clay films on faces of peds; 50 percent gravel and 5 percent cobbles; slightly acid (pH 6.1); clear smooth boundary.

3BC—39 to 48 inches; dark reddish brown (2.5YR 2.5/4) gravelly clay loam, reddish brown (2.5YR 4/4) dry; weak medium and fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; few medium roots; common fine tubular pores; 15 percent gravel; slightly acid (pH 6.1); clear smooth boundary.

3C—48 to 62 inches; dark reddish brown (2.5YR 2.5/4) gravelly clay loam, dusky red (2.5YR 3/2) dry; massive; soft, friable, sticky and slightly plastic; few medium roots; few fine tubular pores; 15 percent gravel; moderately acid (pH 5.8).

The depth to bedrock is 60 inches or more. The particle-size control section contains 25 to 35 percent clay and 50 to 75 percent rock fragments. The mollic epipedon is 16 to 30 inches thick.

The A horizon has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3 moist, 3 to 5 dry; and chroma of 2 to 4 moist, 1 to 4 dry. The 2Bt horizon has hue of 10YR, 7.5YR, or 5YR; value of 2 to 4 moist, 4 to 6 dry; and chroma of 2 to 4 moist and dry. It is very gravelly loam, very gravelly clay loam, or extremely gravelly loam.

Woodseye Series

The Woodseye series consists of shallow, somewhat excessively drained soils on hillslopes. These soils formed in colluvium derived from igneous rock. Slopes are 3 to 80 percent. The mean annual precipitation is about 43 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Woodseye very stony loam, in an area of Woodseye-Rock outcrop complex, 3 to 35 percent slopes, about 1 mile north of Dead Indian Road; about 845 feet north and 2,215 feet east of the southwest corner of sec. 8, T. 38 S., R. 3 E.

A1—0 to 2 inches; dark brown (7.5YR 3/2) very stony loam, brown (10YR 5/3) dry; weak thin platy structure; soft, friable; slightly sticky and slightly plastic; few very fine roots; many very fine vesicular pores; 5 percent gravel, 5 percent cobbles, and 25 percent stones; slightly acid (pH 6.2); abrupt smooth boundary.

A2—2 to 8 inches; dark brown (7.5YR 3/3) very cobbly loam, brown (10YR 4/3) dry; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine irregular pores; 10 percent gravel and 45 percent cobbles; slightly acid (pH 6.4); clear wavy boundary.

Bw—8 to 18 inches; dark brown (7.5YR 3/4) very cobbly loam, brown (10YR 4/3) dry; weak fine subangular blocky structure parting to weak fine granular; soft, friable, slightly sticky and slightly plastic; common very fine roots; few very fine tubular pores; 20 percent gravel and 25 percent cobbles; slightly acid (pH 6.4); abrupt wavy boundary.

R—18 inches; andesite.

The depth to bedrock is 10 to 20 inches. The particle-size control section contains 50 to 80 percent rock fragments and 18 to 27 percent clay. The umbric epipedon is 7 to 16 inches thick.

The A horizon has hue of 10YR or 7.5YR; value of 2 or 3 moist, 4 or 5 dry; and chroma of 2 or 3 moist and dry. The Bw horizon has hue of 10YR or 7.5YR; value of 3 to 5 moist, 4 to 6 dry; and chroma of 2 to 6 moist and dry. It is very cobbly or extremely cobbly loam.

Xerorthents

Xerorthents are very deep to moderately deep, well drained and moderately well drained soils on flood plains, stream terraces, and alluvial fans. These soils formed in material that was deposited after the landscape was mined. This material commonly is referred to as mine tailings. Slopes are 0 to 15 percent. The mean annual precipitation is about 32 inches, and the mean annual temperature is about 50 degrees F.

Reference pedon of Xerorthents, in an area of Xerorthents-Dumps complex, 0 to 15 percent slopes, in a mined stream basin about 6 miles south of Jacksonville; about 2,500 feet west and 600 feet north of the southeast corner of sec. 33, T. 38 S., R. 2 W.

A—0 to 6 inches; dark brown (7.5YR 4/4) very cobbly clay loam, pale brown (10YR 6/3) dry; weak medium and moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine irregular pores; 10 percent gravel and 25 percent cobbles; moderately acid (pH 5.8); clear wavy boundary.

C1—6 to 18 inches; reddish brown (5YR 4/4) very cobbly clay loam, light brown (7.5YR 6/4) dry; massive; very hard, friable, sticky and plastic; common fine and medium roots; many very fine and fine irregular pores; 20 percent gravel and 35 percent cobbles; moderately acid (pH 5.6); clear wavy boundary.

C2—18 to 60 inches; reddish brown (5YR 4/4) extremely cobbly clay loam, light brown (7.5YR 6/4) dry; massive; very hard, firm, sticky and plastic; common fine and medium roots; many very fine and fine irregular pores; 30 percent gravel and 40 percent cobbles; moderately acid (pH 5.6).

The depth to bedrock is 20 inches or more. The control section contains 25 to 90 percent rock fragments, of which 10 to 70 percent is cobbles. The particle-size control section contains 10 to 35 percent clay.

The A horizon has hue of 7.5YR or 10YR; value of 3 or 4 moist, 5 to 7 dry; and chroma of 2 to 4 moist and dry. In the fine-earth fraction, it is clay loam to sandy clay. It contains 25 to 90 percent rock fragments. The C horizon has hue of 5YR to 10YR; value of 3 to 5 moist, 5 to 7 dry; and chroma of 2 to 6 moist and dry. In the fine-earth fraction, it is clay loam to sandy loam. It contains 25 to 90 percent rock fragments.

Formation of the Soils

By Russell A. Almaraz, soil scientist, Soil Conservation Service.

Soil is a natural, three-dimensional body on the earth's surface that supports plants. Its characteristics and properties are determined by physical and chemical processes that result from the interaction of five factors—climate, plant and animal life, parent material, topography, and time.

The influence of each factor varies from place to place. Some factors are more influential than others. The interaction among all the factors determines the kind of soil that forms. Parent material, climate, and topography are responsible for most of the differences among the soils in the survey area.

In this section the effects of climate and of plant and animal life are described under separate headings. The effects of time, parent material, and topography are described under the heading "Geomorphology."

Climate

The most important climatic factors that affect soil formation are precipitation and temperature. Climate controls the chemical and physical reactions that take place in the soil. Temperature affects the rate of chemical reactions and the movement of soil particles, such as that caused by the freezing of water. Freezing and thawing of water can cause the expansion and contraction of soil particles, thereby influencing the movement of both the particles and the rock fragments in the soil *(4)*. The rate at which organic matter decomposes and accumulates is controlled by the temperature and moisture content of the soil.

This survey area has four major climate zones (fig. 18), each of which has a distinctive influence on soil genesis. These zones are described in this section.

Climate Zone 1

This zone receives less than 35 inches of annual precipitation and generally is at elevations of about 4,000 feet. The soil temperature regime is mesic. The zone is characterized by hot, dry summers and cool, moist winters. Most of the precipitation is received as rainfall. Most of the soils contain a moderate amount of bases because the mineralogy of the parent material is mixed. The amount of precipitation is not high enough to leach most of the bases out of the soil profile. The soils in this zone include those of the Vannoy series (Mollic Haploxeralfs) and those of the Caris series (Typic Xerochrepts). Some of the soils are in Ultic subgroups of Xerolls formed dominantly in material that is relatively low in content of bases. Examples are Medco soils (Ultic Haploxerolls) and Skookum soils (Pachic Ultic Argixerolls).

Climate Zone 2

This zone receives more than 35 inches of annual precipitation and generally is at elevations of about 4,000 feet. The soil temperature regime is mesic. The zone is characterized by hot, dry summers and cool, moist winters. Most of the precipitation in winter is received as rainfall. The amount of precipitation is high enough to result in the leaching of bases and the illuviation of clay. Among the soils in this zone are those of the McNull series (Ultic Argixerolls), the Lettia series (Ultic Haploxeralfs), and the Beekman series (Dystric Xerochrepts).

Climate Zone 3

This zone receives 20 to 60 inches of annual precipitation and generally is at elevations between 3,500 and 6,000 feet. The soil temperature regime is frigid. The zone is characterized by warm, dry summers and cold, moist winters. Precipitation falls as rain most of the time; however, much snow accumulates in some winters. Bases are readily leached from the soils because of the amount of precipitation received. Cool temperatures slow the decomposition of organic matter, which thus accumulates in the soils. These processes contribute to the formation of such soils as those of the Donegan series (Pachic Xerumbrepts) and those of the Pinehurst series (Pachic Ultic Argixerolls). In areas where the amount of precipitation is more limited, the leaching of bases is not so extensive. The soils in these areas have relatively high base saturation. Bly and Royst soils (Pachic Argixerolls) are examples.

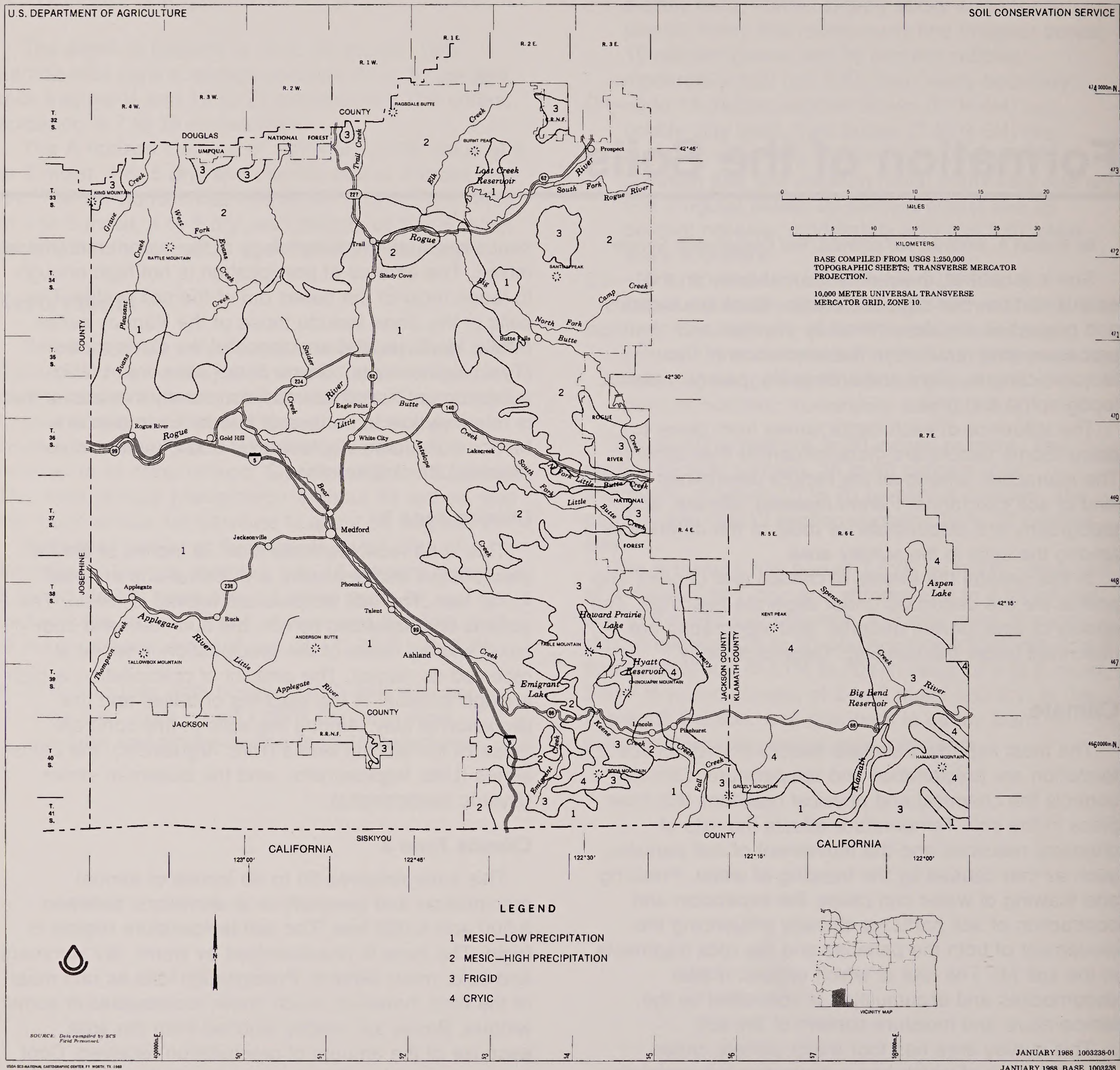


Figure 18.—The major climatic zones in the survey area.

Climate Zone 4

This zone generally receives less than 45 inches of annual precipitation and in most areas is between elevations of about 3,800 and 6,600 feet. The soil temperature regime is cryic. The zone is characterized by cool, dry summers and cold, moist winters. Precipitation occurs mainly as snow. The cold temperatures in this zone significantly restrict the activity of micro-organisms. As a result, organic matter accumulates in the soils. Under these conditions, soils

that have a thick mollic epipedon form. An example is Pokegema soils (Pachic Cryoborolls). Physical weathering of bedrock through the freezing and thawing can result in soils that have many rock fragments and exhibit poor profile development. An example is Oatman soils (Dystric Cryochrepts).

Plant and Animal Life

The kind and abundance of organisms living in or on the soil are dynamic factors of soil formation that are influenced by the characteristics of the parent material, the climate, the topography, and the age of the soil. The composition of the organisms in and on the soil determines the kind and amount of organic matter added to the soil. The breakdown of organic residue releases the nutrients contained in the soil and results in continuous recycling of the nutrients. The plants and animals feeding on the organic debris become part of the total organic matter complex. In this survey area, parent material and climate are the environmental factors that have the greatest effect on vegetation.

One of the most important roles of plants and animals in soil formation is the differentiation of horizons in the soil profile. Earthworms, rodents, insects, micro-organisms, and other organisms enhance important soil-forming processes, such as the accumulation of organic matter, nutrient cycling, stabilization of soil structure, profile mixing, and additions of plant nutrients. They also influence soil acidity and improve soil aeration and drainage. Because of complex climatic and geologic patterns, the survey area has highly diverse plant species and vegetative patterns *(5)*.

The annual leaf drop of deciduous vegetation contributes significantly to the accumulation of organic matter in the soil. The accumulation generally is greater in mixed stands of hardwoods and conifers than in pure stands of conifers. The forests dominated by hardwoods commonly are at the lower elevations. The warmer mean annual soil temperatures are likely to result in a large population of micro-organisms, which incorporate a large amount of organic matter into the soil.

The following paragraphs describe the effects of vegetation on soil formation in the four climate zones in the survey area.

Climate zone 1.—The interior valleys of the Rogue and Applegate Rivers and of Evans and Bear Creeks are in this zone. They are used mainly for cultivated crops and urban development. The native vegetation, however, is still dominant in numerous areas.

The riparian vegetation on the flood plains is mostly hardwood trees and numerous shrubs, forbs, and grasses *(3)*. The deciduous vegetation contributes a large amount of organic matter to the soil. The roots take up calcium and other bases, which are returned to the soil annually when leaves and twigs drop to the ground in the fall. This process helps to compensate for the loss of bases caused by leaching. The annual dieback of roots returns a large amount of organic matter to the soil. During periods of flooding, silt and sand high in content of organic matter are deposited on the surface. These processes contribute to the formation of Mollisols. Newberg soils (Fluventic Haploxerolls), which are near streams, accumulate organic matter and deposits of sand during periods of flooding. Evans soils (Cumulic Haploxerolls) formed farther away from the streams, in backwash areas. Organic matter has accumulated in these soils as a result of a dense plant cover and the deposition of silty material high in content of organic matter during periods of flooding.

The natural vegetation on the terraces and foothills in the valleys is mainly hardwood trees and various shrubs, forbs, and grasses *(5)*. In most areas in the valleys, the proportion of hardwood trees and grasses is significantly higher than the proportion of conifers. The organic matter derived from the deciduous trees and shrubs decomposes more readily under the influence of the warm temperatures in the valleys. As a result, plant nutrients are more rapidly recycled. The amount of annual rainfall is moderate. It does not result in excessive leaching of bases. Examples of the soils in these areas are those of the Ruch series (Mollic Palexeralfs) and those of the Barron series (Typic Xerochrepts).

In the soils on the uplands in this zone, accumulations of organic matter are derived mainly from conifers, deciduous hardwoods, and shrubs. Nutrient cycling and limited precipitation have contributed to the formation of soils that have high base saturation. Examples are Vannoy and Voorhies soils (Mollic Haploxeralfs).

Climate zone 2.—This zone is characterized by a low proportion of deciduous hardwood trees and shrubs and a high proportion of conifers. A high amount of annual precipitation and warm temperatures in this zone have resulted not only in the leaching of most bases but also in the rapid decomposition of the organic matter on and in the soils. Such soils as those of the Acker series (Typic Haploxerults), the Lettia series (Ultic Haploxeralfs), and the Beekman series (Dystric Xerochrepts) formed in this zone.

Climate zone 3.—This zone dominantly supports conifers and shrubs. Although the conifers generally supply the soils with enough bases, the amount of annual precipitation in this zone is high enough to leach many of the bases from the profile. Such soils as those

of the Jayar and Rogue series (Dystric Xerochrepts) formed in this zone.

Climate zone 4.—Relatively little organic matter is added to the soils in this zone because conifer forest vegetation is dominant and the understory vegetation is sparse. Also, cool temperatures slow the decomposition of organic matter. Examples of soils in this zone are those of the Hobit series (Typic Cryandepts) and those of the Otwin series (Andic Cryochrepts).

Soils in depressional areas where the water table is high support such vegetation as grasses and sedges rather than conifers or hardwoods. The decomposition of this vegetation commonly results in soils that have a high content of organic matter and a thick mollic epipedon. Examples of such soils are those of the Klamath series (Cumulic Cryaquolls) and those of the Sibannac series (Cumulic Haplaquolls).

Geomorphology

The major landforms in this survey area have been divided into four physiographic provinces (fig. 19). These provinces are areas that have had a similar geomorphic history and have similar geologic structures and topographic relief, which are factors that greatly influence soil genesis. The formation of the soils in one physiographic province commonly is influenced by the geology of the other physiographic provinces.

Western Oregon Interior Valleys Province

This province includes the interior valleys of the Rogue and Applegate Rivers and their major tributaries. The main alluvial landforms are flood plains, terraces, and alluvial fans. The soils in this province formed mainly in thick alluvial deposits of various ages.

Late in the Pliocene, the climate in this survey area became cooler and glaciers formed at the higher elevations of the Cascade and Klamath Mountains. Much material was eroded by the glaciers and carried downslope by iceflow and meltwater *(4)*. The material was then deposited, along with other rock material and silt, as alluvium in the valleys of the major streams and formed the older of the present-day geomorphic surfaces.

The geomorphic surfaces in the valley of the upper reaches of the Rogue River occur as a sequence of land surfaces that reflects their geomorphic age and kind or degree of profile development (fig. 20). These geomorphic surfaces extend to the major tributaries of the Rogue River. They are described in the following paragraphs.

Horseshoe surface.—This surface is on the lower of the two flood plains along the Rogue and Applegate Rivers and along many of their tributaries. Flooding can occur annually. The surface is characterized by low relief and includes the river channels, some of which have been filled; point bar deposits; and abandoned meanders. The surface generally is underlain by alluvial sand and gravel. In places it is underlain by bedrock. Metallic artifacts in the alluvium indicate that formation of the surface probably began after settlement of the valley of the Rogue River *(17)*.

Accumulations of organic matter and weak grades of soil structure are the only morphological evidence of soil formation in the Camas soils (Fluventic Haploxerolls) on this surface. The content of organic matter in these soils irregularly decreases as depth increases, indicating that the parent material was recently deposited by water.

Eagle Point surface.—This surface is on the higher of the two flood plains in the interior valley. It is between the TouVelle and Horseshoe surfaces. It formed during the late Holocene. The topography of the surface typically is characterized by undulating corrugations that have a maximum relief of about 6 feet. It is the result of the channeling that occurs when streams overflow their banks. Flooding is common on this surface.

Horizon development in the soils on this surface is limited to the accumulation of organic matter and the formation of a cambic horizon. The soils include Newberg soils (Fluventic Haploxerolls), which formed in sandy alluvium, and Evans soils (Cumulic Haploxerolls), formed in silty alluvium. In both of these soils, the content of organic matter irregularly decreases as depth increases. Evans soils are higher on the landscape than Newberg soils and have a more strongly developed cambic horizon.

TouVelle surface.—This surface is one of the most extensive geomorphic surfaces in the upper reaches of the valleys of the Rogue River and Bear Creek. It consists mainly of alluvial terraces characterized by low relief and bar-and-channel topography. The surface layer of the soils on this surface is mostly medium textured and is underlain by sand and gravel. In some areas the soils have a thin layer of ash from Mt. Mazama.

Radio-carbon dating of charcoal from a sycamore tree *(Platanus racemosa)* recovered from a pumice flow along the upper reaches of the Rogue River indicates that the maximum age of the TouVelle surface is 6,930 years, plus or minus 115 years *(17)*. Therefore, it is likely that the surface formed during the early or middle Holocene.

The parent material is an important factor in the formation of the soils on this geomorphic surface. The source of the alluvial parent material is the volcanic rock of the Cascade Mountains or the metamorphic and granitic rock of the Klamath Mountains.

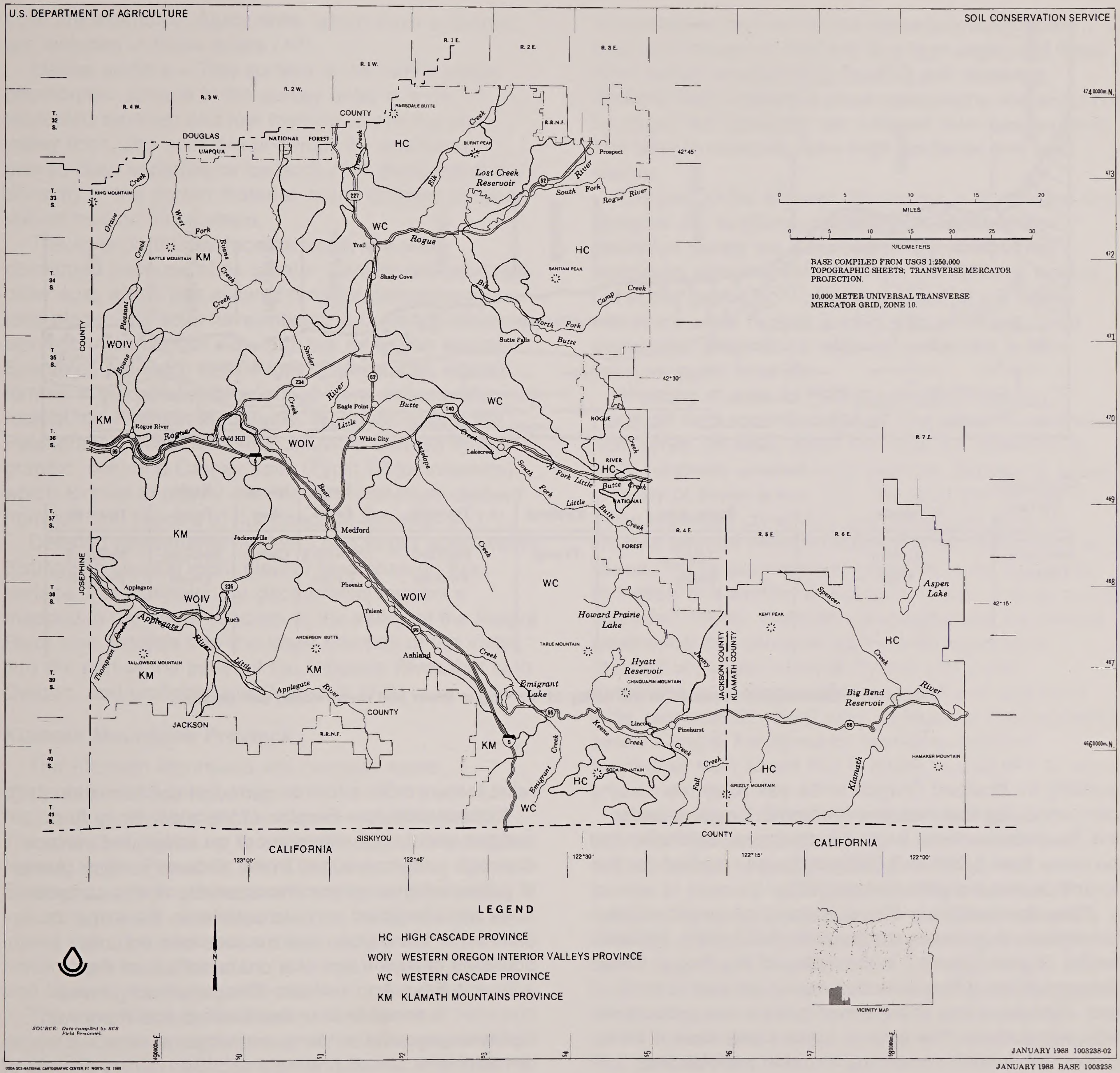
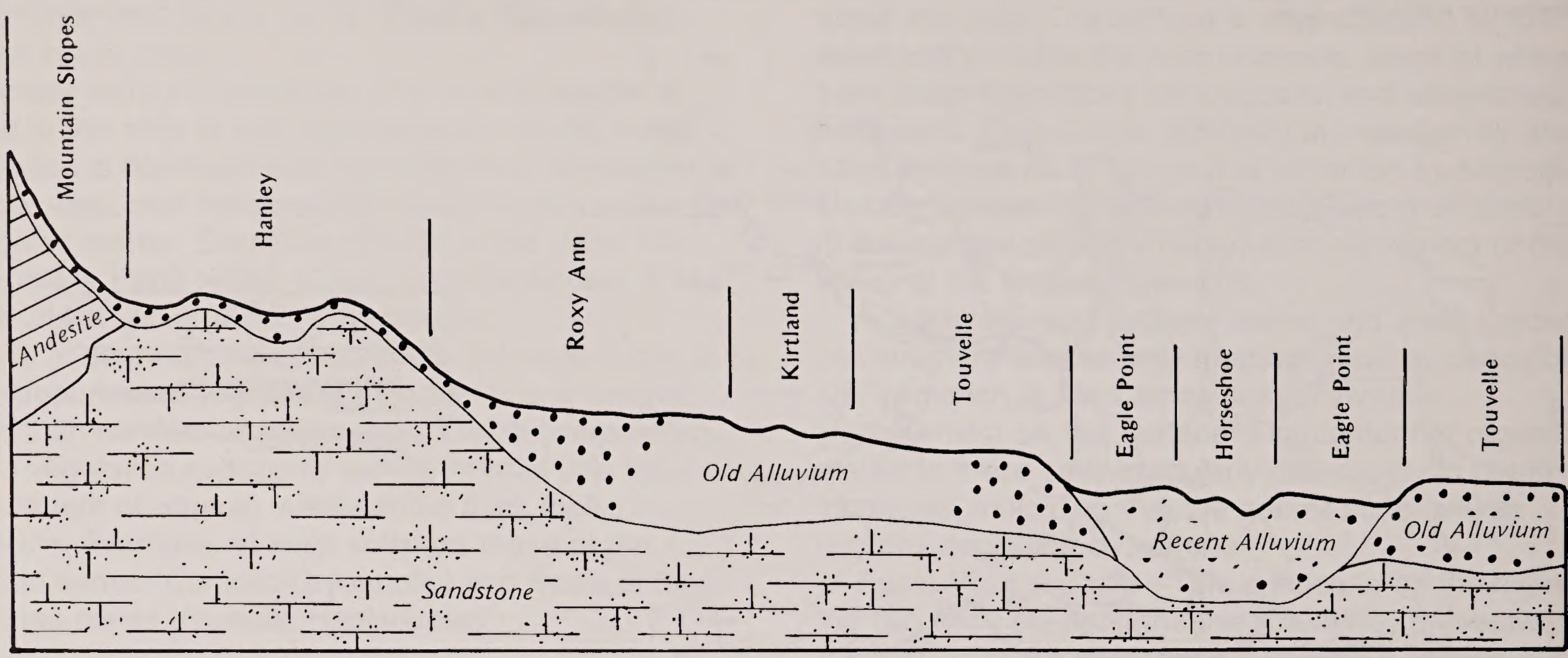


Figure 19.—The physiographic provinces in the survey area.

The main kind of parent material on this surface is mixed alluvium that is coarse textured or fine textured. The soils that formed in the coarse textured, mixed alluvium generally have a cambic horizon. An example is Central Point soils (Pachic Haploxerolls). The alluvial parent material of these soils weathered from granitic rock in the Klamath Mountains. Examples of soils that formed in fine textured, mixed alluvium are those of the Medford series (Pachic Argixerolls) and those of the Foehlin series (Typic Argixerolls). These soils have an argillic horizon. Radio-carbon dating has indicated an age of 2,355 years (plus or minus 90 years) for a



Geomorphic Surface	Hanley	Roxy Ann	Kirtland	Touvelle	Eagle Point	Horse-shoe	Eagle Point	Touvelle
Soil Series (Major)	Carney Ruch	Agate Winlo	Provig	Medford Foehlin	Newberg Evans	Camas	Newberg Evans	Medford Foehlin

Figure 20.—Geomorphic surfaces in the valley of the Rogue River and their related soil series.

partially mineralized Oregon white oak *(Quercus garryanna)* log that had been buried 2.7 meters under the TouVelle surface. It can be assumed, therefore, that no more than 2,000 to 3,000 years was required for the formation of an argillic horizon *(17)*.

Roxy Ann surface.—This surface is on an extensive fan terrace that makes up the main flood plain, known as the "Agate Desert," in the valley of the Rogue River. Topographical differences commonly are less than 3 feet. Circular areas of patterned ground are associated with this surface. The soils in these areas have a silica-cemented duripan containing rounded pebbles and cobbles. The surface drainage pattern is poorly expressed. No specimens are available for radio-carbon dating of this surface. On the basis of the position of the soils on the landscape and their degree of weathering, however, the surface is estimated to be of late Pleistocene age *(17)*.

Examples of the soils on this surface are those of the Agate series (Typic Durochrepts) and those of the Winlo series (Typic Duraquolls). The contrast between the sizes of the particles in the solum and those in the duripan of these two soils indicates that the duripan is a relict feature from a former period of soil formation *(17)*.

Kirtland surface.—Erosion of the older Roxy Ann surface and the development of an integrated surface drainage pattern resulted in the Kirtland surface. Areas of patterned ground are characteristic of this surface. They are elongated and are parallel to the slope, in contrast to the circular soil mounds and equant polygons of rock fragments characteristic of the adjacent Roxy Ann surface. The patterned ground common in areas of both the Kirtland and Roxy Ann surfaces suggests a nearly contemporaneous development, which probably occurred during periods of extensive alpine glaciation in the Cascade Mountains. The next younger and lower surface, the TouVelle surface, has no patterned ground. Therefore, the Kirtland surface probably formed during the late Pleistocene *(17)*.

Provig soils (Typic Argixerolls) are typical of the soils in areas of this surface where the duripan that is typical of the Roxy Ann surface has been truncated by an ancient erosion cycle and an argillic horizon has subsequently formed. Where the Kirtland surface is characterized by moderate relief, areas of the Provig

soils are extensive. Agate soils, which have a duripan, are included in these areas *(17)*.

Hanley surface.—This surface is the oldest stable geomorphic surface in the survey area. It is on dissected terraces and low foothills above the main valley floor. The soils are underlain by weathered gravel, clay, saprolite, or bedrock *(17)*. Because of the diversity of the parent material, many different kinds of soil formed on this surface.

The soils on this surface generally are well developed because of its greater stability and relatively older age, which has allowed time for pedogenesis to take place. The soils have moderate or strong structure, are high in content of clay, or have an argillic horizon. Examples are Ruch soils (Mollic Palexeralfs), which formed in mixed alluvium derived from metamorphic rock of the Klamath Mountains; Wolfpeak soils (Ultic Palexeralfs), which formed in alluvium derived from granitic rock; and Carney soils (Typic Chromoxererts), which formed in clayey alluvium and colluvium derived from tuff and breccia of the Cascade Mountains *(17)*.

Detailed geomorphic mapping at a larger scale would distinguish several more distinct landforms on this surface. For example, the geomorphic sequence mapped in the upper reaches of the valley of the Rogue River also extends into the lower reaches of the valley, into the part of the basin of the Umpqua River that is in Oregon, and probably into California *(17)*.

Klamath Mountains Province

The Klamath Mountains are complex areas characterized by steep, rugged terrain. They are in a region of ancient and highly altered rock formations. The rock that makes up the Klamath Mountains began forming in the Paleozoic and Triassic periods. Sediment, including limestone-forming material and volcanic material, was deposited on the floor of an inland sea. The sediment subsequently was metamorphosed, altered by heat and pressure, folded and faulted, and then uplifted to form mountains.

The metamorphic processes probably were associated with an early phase of "sea-floor spreading," or plate tectonics *(10)*. During the Jurassic and mid-Cretaceous periods, there was an episode of intrusion of granitic material into the overlying rock. During these periods emplacement of the Ashland Pluton and many other smaller granitic intrusions occurred throughout the Klamath Mountains. The granitic bodies of the Blue Mountains and the Sierra Nevada also intruded at this time *(10)*. Minor intrusions of ultramafic rock, such as peridotite and serpentinite, occurred earlier in the Triassic period.

The intense geologic deformation of the Klamath Mountains commonly has weakened the rock. The metamorphic rock structures commonly have been weakened because they are at a high angle and have been further weakened by faulting and shearing. Streams have created a steep topography characterized by ridges that generally are oriented from east to west. The stream channels have high gradients and are narrow.

The part of the Klamath Mountains in the survey area escaped the landform modifications resulting from glaciation during the Pleistocene. Because of the periglacial environment, however, the streams flowing out of the region from glaciated areas at the higher elevations were heavily loaded with sediment. Thick deposits of glaciofluvial material are on the high terraces in the area *(4)*.

A variety of soils formed in metasedimentary material, metavolcanic material, and material weathered from schist. In steep areas the soils are underlain by hard, relatively unweathered bedrock. Erosion is active in many of these areas *(16)*. The soils that formed in these materials commonly are moderately deep or shallow and are medium textured. Their mineralogy is mixed. Profile development generally is limited to the formation of a cambic subsurface horizon and an ochric epipedon. Steep, unstable topography and the intense weathering that occurred as the soils aged have resulted in the formation of Dystric and Typic Xerochrepts. Examples of these are Kanid and Caris soils, respectively. Such soils as those of the Goolaway series (Dystric Xerochrepts) formed in material weathered from schist that is highly susceptible to water erosion.

In many areas bedrock has been weathered to saprolite. The soils that formed in this material exhibit more evidence of profile development than the soils that formed in material weathered from hard bedrock. The soils that formed in colluvium are described as having a lithologic discontinuity in areas where they have hard rock fragments in the solum and are underlain by soft bedrock. These soils are moderately sloping. Examples are Norling soils (Ultic Haploxeralfs) and Josephine soils (Typic Haploxerults). An argillic horizon and hues that generally are redder than those of Ochrepts indicate that there has been a higher degree of weathering.

The northwestern part of the survey area has scattered intrusions of ultramafic rock, such as peridotite and serpentine. The properties of the serpentinitic soils in this area vary significantly; however, high base saturation, a predominance of magnesium as an exchangeable cation, and a low ratio of exchangeable calcium to magnesium are common features. Also, the soils have a low content of available phosphorus and potassium and a neutral reaction. Soils

that formed in material derived from ultramafic rock include those of the Dubakella series (Mollic Haploxeralfs) and those of the Gravecreek series (Dystric Xerochrepts).

Western Cascade Province

There is an irregular boundary between the landforms on the western flank of the Cascade Mountains and the younger volcanic landforms of the High Cascades. The Cascade Mountains are divided into two belts that trend north to south *(4)*. The older, deformed rock is on the west flank of the Cascades, and the undistorted rock is on the High Cascades and the east flank of the Cascades.

The western flank of the Cascades is made up of lava and pyroclastic rock ranging in age from Oligocene to late Miocene. During the Miocene the rock was uplifted, folded, faulted, affected by intruding shallow stocks, and then deeply eroded. The rock dips to the east until it is overlain by more recent flows from shield volcanos of Pliocene to recent age. Rock strata typically include beds of volcanic ash (tuff), large flows of andesite lava, and layers of andesitic breccia and agglomerate.

The soils that formed in the Western Cascade province were directly influenced by the weatherability of the parent material. The strata of hard andesite and basalt include soft breccia and tuffaceous rock. The soils in the areas of this province that receive a greater amount of precipitation commonly are Mollisols because of the interacting influences of the basic mineralogy of the volcanic parent material and the accumulation of organic matter. Soils that formed in material weathered from hard andesite and basalt, such as McMullin soils (Lithic Ultic Haploxerolls), are shallow and medium textured.

Other soils in this province not only formed in material weathered from hard bedrock but also are influenced by soft, easily weathered tuff and breccia. As a result, they are fine textured and have an argillic horizon. Examples are McNull soils (Ultic Argixerolls) and Tatouche soils (Typic Argixerolls). Soils that formed on concave slopes frequently are subject to increased weathering because of the concentration of water and the influence of easily weathered tuff and breccia. In some areas the concave slopes are the result of gravitational mass movement of the regolith. These soils commonly have a dense claypan that is very slowly permeable. Examples are Bybee soils (Typic Haploxerolls) and Medco soils (Ultic Haploxerolls).

The oldest volcanic strata, on the western fringes and foothills of the Cascades, are weathered andesite, tuff, and tuffaceous sedimentary rock. These strata overlie nonmarine sandstone and siltstone sediment of the upper Eocene age *(21)*. The soils that formed in these materials are influenced by accumulations of alluvium and colluvium of volcanic origin and in some areas are underlain by volcanic or sedimentary bedrock. Examples are Carney soils (Typic Chromoxererts) and Darow soils (Vertic Argixerolls) on stable landforms and Heppsie soils (Vertic Haploxerolls) on steep, less stable landforms.

Some of the soils formed solely in sedimentary parent material. They exhibit little evidence of profile development. Brader and Debenger soils (Typic Xerochrepts) are examples.

Fine textured Vertisols formed in basins and areas of low relief where clayey material accumulates. Examples are Kanutchan soils (Typic Pelloxererts) and Coker soils (Chromic Pelloxererts). Coker soils also are in the Western Oregon Interior Valleys Province, where they formed in volcanic alluvial material.

The younger strata characteristic of the Western Cascade province mark its boundary with the High Cascade province. The soils in this area are well developed *(12)*. The landforms are in a youthful stage of development. In some areas the drainageways are characterized by low relief. The bedrock commonly is hard. Examples of soils that formed in this area are those of the Pinehurst series (Pachic Ultic Argixerolls), which are deep and are on concave or linear landforms that are characterized by little local relief, and those of the Farva series (Typic Xerochrepts), which are moderately deep and formed on convex slopes on hills and ridges. These soils formed in colluvium and have many hard rock fragments throughout the solum.

High Cascade Province

The boundary between the western flank of the Cascades and the High Cascades is a separation based on age and general topography. Elevation ranges from about 3,000 feet in the southeastern part of the survey area to about 6,600 feet on some of the higher peaks.

The topography of the youthful High Cascades is characteristically that of a broad upland plateau that has scattered volcanic cones. The landforms are easily recognizable as their original forms because they have been only slightly modified by erosion. The topography is unlike that of the western flank of the Cascades, which is characterized by deeply incised canyons and steeper slopes and by landforms that are almost entirely the result of erosion *(32)*.

The High Cascades began forming in the late Miocene with the extrusion of andesite and basalt *(21)*. These flows, originating from shield volcanos and

fissures, traveled long distances as intercanyon flows on both sides of the Cascades. On the western flank of the Cascades, lava flows of the Pliocene and Pleistocene became intercanyon flows within the drainageways of the Rogue River and Big Butte Creek. The Table Rocks are remnants of these flows *(32)*. On the eastern slope of the Cascades, flows entered the Klamath River Canyon area and, at least once, created a barrier to the river. Periodically, bouldery mudflows containing many rock fragments inundated the landscape.

In the recent Holocene, the explosive eruption of Mt. Mazama, about 6,600 years ago, left a thick blanket of pumice over some areas in the northeastern part of the survey area. Other recent landforms are the cinder cones that are common in the southeastern part of the survey area. They are made up of poorly consolidated ejecta of ash, cinders, scoria, and volcanic bombs *(32)*.

The soils in the High Cascades generally are in an early or intermediate stage of development because of the relative youth of the parent material and the cold climate. Development of the solum has progressed enough in some soils, however, for the formation of a cambic or argillic horizon. The clay mineralogy of these soils varies, depending on the mineralogy of the parent rock and the degree of weathering.

The soils that formed in colluvium on hillslopes in areas of dissected flows and volcanic vents contain many rock fragments. An example is Oatman soils (Dystric Cryochrepts), which has a cambic subsurface horizon. These soils are in the southeastern part of the survey area.

Several soils formed in material derived from mudflows or from other flows of pyroclastic material. These soils vary considerably in mineralogy. The soils that have halloysitic mineralogy are fine textured and are deep over bedrock. Examples are Hukill soils (Typic Rhodoxeralfs) and Pokegema soils (Pachic Cryoborolls). These soils occur locally in some areas outside the High Cascade province as a result of the extent of the intercanyon flows.

The soils that formed in material weathered from pumice and volcanic ash have low bulk density, are highly erodible, and are minimally developed. Examples are Crater Lake and Alcot soils, both of which are Typic Vitrandepts. These soils formed in material that was deposited in the northeastern part of the survey area during the eruption of Mt. Mazama. During the same period, sandy material from glacial activity in the Cascades was deposited in this area. Barhiskey soils (Entic Xerumbrepts), which formed in such material, show little evidence of profile development because of their young age.

When a flow of mud or debris has many rock fragments, the soils that form on the flow commonly contain many hard to soft rock fragments. Woodcock soils (Argic Pachic Cryoborolls), which have mixed mineralogy, probably formed in material derived from such a flow or in glaciofluvial outwash consisting of volcanic material *(4)*. Other soils that contain many rock fragments are those of the Skookum series (Pachic Ultic Argixerolls), which formed on flows and along the edges of flows and have a strongly expressed argillic horizon that has montmorillonitic mineralogy. These soils are extensive in the southeastern part of the survey area, above the Klamath River Canyon.

A unique kind of landform in this survey area is patterned ground *(29)*, which is in nearly level areas of basaltic andesite flows. These areas have circular or elongated mounds that probably formed as a result of a combination of environmental influences. The mounds are relict landforms that developed in areas of loess under the influence of the periglacial climate of the Pleistocene, about 8,000 years ago *(4)*. The patterned ground occurs as a complex of Randcore and Shoat soils. Shoat soils (Typic Xerochrepts) are on the mounds, and the stony Randcore soils (poorly developed Lithic Xerorthents) are in areas between the mounds. Both of these soils also are on the Table Rocks in the Western Oregon Interior Valleys province.

The hillslopes and drainageways in the northern and central parts of the High Cascades are characterized by moderate relief. The soils that formed in these areas commonly are deep. The soils on convex landforms, such as Coyata soils (Typic Xerumbrepts) and Geppert soils (Dystric Xerochrepts), have a high content of rock fragments. The soils in concave and nearly level areas have a low content of rock fragments. Examples are Dumont soils (Typic Haploxerults), which have kaolinitic mineralogy, and Freezener soils (Ultic Haploxeralfs). Because the landforms are stable, these soils have a well developed argillic horizon.

During the Pleistocene, volcanic activity resulted in andesite flows that covered most of the southern extension of the High Cascades within the survey area. This latest period of volcanism was contemporaneous with a period of faulting *(13)*. The resulting faults are aligned from northeast to southwest. Several sets of cinder cones, including the Chicken Hills and Grenada Butte, are aligned parallel with the trend of this faulting.

Bench gravel along the Klamath River forms perched terraces. These terraces may be remnants of a former lakebed that formed when the Klamath River was dammed either through faulting or through volcanic eruption. During this period two maars formed near the Boyle Reservoir by eruption through these water-saturated gravel deposits *(13)*.

Toward the end of the Pleistocene, the area

presently known as the Mountain Lakes Wilderness was covered by glaciers. Glacial outwash formed deposits that are now preserved as perched terraces *(13)*. The soils that formed in this material include those of the Aspenlake and Whiteface series (Duric Cryoborolls).

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Andesite. Fine grained, extrusive igneous rock that has a composition between that of basalt and that of rhyolite. It generally has comparatively large crystals in distinctly finer matrix material.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It commonly is defined as the difference between the amount of water in the soil at field moisture capacity and the amount at wilting point. It commonly is expressed as inches of water per inch of soil.

Back slope. The geomorphic component that forms the steepest inclined surface and principal element of many hillsides. Back slopes in profile are commonly steep, are linear, and may or may not include cliff segments.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Basin. A depressional area that has few, if any, surface drainage outlets.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Breccia. Coarse grained, clastic rock made up of angular broken rock fragments held together by mineral cement or in a fine grained matrix.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus to allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Butte. An isolated small mountain or hill with steep or precipitous sides and a top variously flat, rounded, or pointed that may be a residual mass isolated by erosion or an exposed volcanic neck.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of

a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Canyon. A long, deep, narrow, very steep sided valley with high, precipitous walls in an area of high local relief.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, soil-improving crops and practices more than offset the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers.

Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Delta. A body of alluvium having a surface that is nearly flat and fan shaped, deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

Well drained.—These soils have an intermediate water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless a drainage system is installed. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless a drainage system is installed. Somewhat poorly drained soils

commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except for rice) unless a drainage system is installed.

Drainage, surface. Runoff, or surface flow of water, from an area.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Duripan. A subsurface horizon that is cemented by silica to the degree that fragments from an air-dried sample do not slake in water or hydrochloric acid. A duripan is very firm or extremely firm when moist and is brittle.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. Area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (or 300 meters) and fringes a mountain range or high-plateau escarpment.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Gabbro. Dark, coarse grained basic igneous rock that is the approximate intrusive equivalent of basalt.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Granodiorite. Granitic rock of intermediate composition between that of granite and that of diorite.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is more than 15 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Hillslope. The steep part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of the hill. In descending order, the components of a simple hillslope may include a shoulder slope, a back slope, a foot slope, and a toe slope. Not all of these components, however, are necessarily evident in any given hillslope continuum. Complex hillslopes may include two or more sequences of back slopes or toe slopes.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of

transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Contour flood.—All necessary water-control structures are installed for the efficient distribution of water by surface means, such as contour ditches.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit (geology). Material deposited in

lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand or loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Maar. A broad, low-relief volcanic crater formed by multiple, shallow, explosive eruptions. It is surrounded by a crater ring and may be filled with water.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Metavolcanic rock. One of a wide variety of volcanic rocks that have been subject to metamorphic processes. The degree of metamorphic alteration is not implied by the term.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides and considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Patterned ground. More or less symmetrical landforms, such as circles, polygons, nets, stripes, and

garlands, that are characteristic of, but not confined to, mantles subject to intense frost action, such as that in periglacial environments.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland mass with a relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential native plant community. See Climax plant community.

Prescribed burning. The application of fire to land under such conditions of weather, soil moisture, and time of day as presumably results in the intensity of heat and spread required to accomplish specific forest management, wildlife, grazing, or fire hazard reduction purposes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Puddling. Compaction of a soil during wet periods to the point that the soil particles are rearranged to a massive state.

Pumice. A light colored, vesicular, glassy rock fragment of volcanic origin. It has enough buoyancy to float on water.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Schist. Metavolcanic rock that has been largely or completely recrystallized and exhibits strong parallel or planar arrangement of platy or prismatic mineral grains. It can readily split into thin plates or slabs.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Serpentine. A greenish, greenish yellow, or greenish gray rock that has a greasy or silky luster and a tough, conchoidal fracture. It formed as an alteration product from magnesium-rich silicate minerals and is evident in igneous or metamorphic rock.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall or surface runoff.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site class. A grouping of site indexes into five to seven production capability levels. Each level can be represented by a site curve.

Site curve (50-year). A set of related curves on a graph that shows the average height of dominant trees for the range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant trees that are 50 years old or are 50 years old at breast height.

Site curve (100-year). A set of related curves on a graph that shows the average height of dominant and codominant trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Skid trail. A trail or furrow made by a log or logs skidding over the ground surface.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils,

slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 6 to 15 inches (15 to 38 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Tailwater. The water just downstream of a structure.

Talus. Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep, rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and

are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Ultramafic rock. Rock that has a relatively high content of iron, less than 45 percent silica, and virtually no quartz or feldspar. Includes peridotite and serpentinite.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Vegetative site. A distinctive kind of site that produces a characteristic natural plant community that differs from natural plant communities on other vegetative sites in kind, amount, and proportion of forage plants.

Volcanic ash. Pyroclastic material less than 2 millimeters in diameter.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Windthrow. The uprooting and tipping over of trees through the action of the wind.

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